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**Increasing Adherence To Digital Mental Health Interventions
Delivered In The Workplace**

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Submitted in fulfilment of the requirements for the degree of Doctor of
Philosophy in Psychology

School of Psychology

University of Sussex

April 2018

Declaration

The thesis conforms to an ‘article format’ in which the middle chapters consist of discrete articles written in a style that is appropriate for publication in peer-reviewed journals in the field. The first, second and final chapters present synthetic overviews and discussions of the field and the research undertaken. References to these chapters are at the end of the thesis.

All of the papers in this thesis have been accepted or submitted for publication in peer-reviewed journals and the versions presented here are the final published or submitted manuscripts. The papers reflect my own work with supervisor input from the other authors. I wrote the first draft and took the lead on all subsequent revisions including those suggested as part of the peer review process. Full references are detailed below:

Chapter 3 is published in *Journal of Medical Internet Research* as:

Carolan, S., Harris, R. P., & Cavanagh, K. (2017.). Improving Employee Well-Being and Effectiveness: Systematic Review and Meta-Analysis of Web-Based Psychological Interventions Delivered in the Workplace. *J Med Internet Res*, 19(7): e271. DOI:10.2196/jmir.7583

The author contributions are as follows: Stephany Carolan conceptualised the study, developed the search thread, conducted the searches, identified the studies and extracted the data, analysed and interpreted the data and wrote the first manuscript. Professor Peter Harris and Dr Kate Cavanagh contributed to subsequent drafts and the design of the study.

Chapter 4 is published in *Internet Interventions* as:

Carolan, S., Harris, P. R., Greenwood, K., & Cavanagh, K. (2017). Increasing engagement with an occupational digital stress management program through the use of an online facilitated discussion group: Results of a pilot randomised controlled trial. *Internet Interventions*, 10(Supplement C): 1–11. DOI:10.1016/j.invent.2017.08.001

The author contributions are as follows: Stephany Carolan conceptualised the study, collected, analysed and interpreted the data and wrote the first manuscript. Professor Peter Harris, Dr Kathryn Greenwood and Dr Kate Cavanagh contributed to subsequent drafts and the design of the study.

Chapter 5 is published in *JMIR Mental Health* as:

Carolan, S., & de Visser, R.O. (2018). Employees Perspectives on the Facilitators and Barriers to Engaging With Digital Mental Health Interventions in the Workplace: Qualitative Study. *JMIR Mental Health*, 5(1): e8. DOI:10.2196/mental.9146

The author contributions are as follows: Stephany Carolan contributed to the design, coordinated and carried out interviews and data analysis and drafted the first manuscript. Dr Richard de Visser participated in the design, data analysis and the subsequent drafts of the manuscript.

Chapter 6 has been submitted for publication as:

Carolan, S., & de Visser, R. O., (2018). Organisational perspectives on purchasing digital mental health interventions for the workplace: A qualitative study. Manuscript submitted for publication.

The author contributions are as follows: Stephany Carolan contributed to the design, coordinated and carried out interviews and data analysis and drafted the first manuscript. Dr Richard de Visser participated in the design, data analysis and the subsequent drafts of the manuscript.

Appendix 1 is the published protocol for Chapter 4. It is published in *Trials* as:

Carolan, S., Harris, P. R., Greenwood, K., & Cavanagh, K. (2016). Increasing engagement with, and effectiveness of, an online CBT-based stress management intervention for employees through the use of an online facilitated bulletin board: Study

protocol for a pilot randomised controlled trial. *Trials*, 17(1): 598.

DOI:10.1186/s13063-016-1733-2

The author contributions are as follows: Stephany Carolan conceptualised the study and wrote the first manuscript. Professor Peter Harris, Dr Kathy Greenwood and Dr Kate Cavanagh contributed to subsequent drafts and the design of the study.

.....

I hereby declare that this thesis has not been and will not be, submitted in whole or in part to another University for the award of any other degree.

Signature:.....

Acknowledgments

I have been lucky to work with three excellent supervisors: Dr Kate Cavanagh, Professor Peter Harris and Dr Richard de Visser. Thank you Kate for seeing the potential in me, for sharing your enthusiasm for digital mental health, and for allaying my anxieties. Thank you Pete for your support, enthusiasm and kindness, and for reminding me that I am better than I think I am. Thank you Richard for your encouragement, for your generosity with your time and knowledge, and for getting me across the finishing line. I am grateful to you all.

I would like to thank all the participants in the studies. Without the generous giving of their time and the sharing of their experiences, this thesis would be a lot less interesting.

My thanks also to the University of Sussex Library for providing funding to publish some of my studies in open access journals, and to the ISRII Local Organising Committee for awarding me funding to travel to the ISRII 2017 conference. I am very grateful for both these opportunities and sincerely believe that they helped me to become a more accomplished researcher.

Dedication

To Steven and Jacques.

With love.

Summary

Title: Increasing Adherence To Digital Mental Health Interventions Delivered In The Workplace.

Background

Work related stress, depression and anxiety are common. Despite evidence that these problems can be successfully treated in the workplace, take-up of psychological treatments by workers is low, resulting in many going untreated. One way to address this may be through the use of digital mental health interventions (DMHIs) in the workplace, but there is a lack of information about their appeal and effectiveness.

Research questions

1. What is the evidence for delivering DMHIs in the workplace?
2. What are the advantages and disadvantages to delivering DMHIs in the workplace?
3. What features of DMHIs influence engagement and adherence? What can be done to improve these?
4. What are employers' priorities when selecting DMHIs for their workforce?

Method of investigation

Mixed methods were used to answer the research questions.

Summary of conclusions

There is evidence for the efficacy of workplace DMHIs, especially if they are delivered over a short timeframe, utilise secondary modalities to deliver the interventions (emails and text messages), and use elements of persuasive technology (self-monitoring and tailoring). Use of online-facilitated discussion groups may increase engagement. Both employees and employers identified convenience, flexibility, and anonymity as advantages of DMHIs. Employers also valued the potential of DMHIs to reach many employees. The main barrier to engagement for employees was lack of time. For employers, barriers to purchasing DMHIs were employees' lack of access to equipment, and their low interest and skills. Cost and effectiveness were priorities for decision makers when purchasing DMHIs. Further work needs to be done with workers and employers to design and deliver DMHIs that meet both their needs.

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1 Background

1.1 Introduction

This chapter provides an overview of the management of common mental health problems in the workplace, arguing that one way to address the low take up of psychological interventions amongst workers is through the use of evidence-based interventions delivered via the Internet. It begins with a summary of research on the prevalence and the consequences of poor mental health in the workplace. It then offers a conceptualisation of occupational stress: discussing why stress as a concept is problematic, and describing the physiological and psychosocial models of stress as well as three work-specific models that have played a prominent role in developing our understanding and the subsequent treatment of the phenomena. The chapter then describes individual and organisational levels of stress management interventions, and how the principles of public health prevention have been translated into an organisational stress context. It then moves on to talk about delivering mental health care and promotion in the workplace arguing that there is evidence that common mental health problems can be successfully treated in the workplace, but despite this evidence, take-up of psychological treatments by workers is low, resulting in many of them going untreated or inadequately treated. One way to address this low take-up may be through the utilisation of the Internet. The chapter concludes with an overview of the evidence for Internet-delivered psychological therapies, suggesting that the evidence for delivering these interventions in the workplace is not as robust as it is for delivering them in community and health settings, and that one of the challenges to delivering Internet interventions is low engagement and adherence. More work is needed to understand the barriers and facilitators to delivering evidence-based Internet interventions in occupational settings and to understand how we can increase engagement and adherence to them.

1.2 Prevalence and consequences of mental health problems in the workplace

1.2.1 Prevalence of work related stress, depression and anxiety

Nearly one in three workers in Europe (Leka & Jain, 2010) and the United States (American Psychological Association, 2010) report that they are affected by stress at work. Reporting on the prevalence rates of work-related stress, depression and anxiety in the UK varies, a recent 2016 survey of 2,056 working adults reported that 5% of employees said that their mental health was poor or very poor (CIPD, 2016). The Health and Safety Executive (HSE) reporting the 2015/16 Labour Force Survey suggests that the prevalence of work related stress, depression and anxiety was 1.5% (HSE, 2016). Even taking the lowest estimate, the cost to the UK economy is high: common mental health conditions account for 11.7 million lost working days, which is 45% of all working days lost due to ill health (HSE, 2016); this has been estimated to cost the British economy £3.6 billion a year (HSE 2010/11 cited in EU-OSHA 2014). The World Health Organisation (WHO, 2015) describes mental health disorders as one of the greatest public health challenges in Europe, and the main cause of disability and early retirement: the resultant extended periods off work on sick leave are a growing challenge for many countries (WHO, 2015).

1.2.2 Cost to the employer

As well as the cost to the national economy of common mental health problems in the workplace, there is a cost to organisations. Depression and other common mental health problems are associated with reduced productivity (Birnbaum et al., 2010; Dewa, Thompson & Jacobs, 2011; Gutman & Nemeroff, 2011; Harvey et al., 2011; Waghorn, Chant, White & Harvey, 2005), increased sickness absence (Bültmann et al., 2006; Henderson, Glozier & Holland Elliott, 2005), increased presenteeism (not working at capacity while at work; Cancelliere, Cassidy, Ammendolia & Côté, 2011; Henderson, Harvey, Øverland, Mykletun & Hotopf, 2011), increased staff turnover through health-related job loss (Solomon, Poole, Palmer, & Coggon, 2007), and early retirement (Karpansalo et al., 2005). Rates of self-reported work-related stress have doubled in the last 25 years (HSE, 2015, 2016). This increase is also reflected in the take-up of

sickness and disability benefits. Mental health disorders (predominantly depression and anxiety) are now the most common cause of receiving sickness benefits: while the number of claimants for any type of sickness benefit declined by 6.4% between 1995 and 2014, the number of claimants with mental disorders increased by 103% accounting for almost half of all claims (Viola & Moncrieff, 2016). Explanations for this increase in the prevalence of stress and other common mental health problems include an increase in reporting as a result of reduced stigma (Viola & Moncrieff, 2016), greater social isolation as seen by the growth of single households, the increased use of electronic communication as opposed to face-to-face communication (CIPD, 2008), and the changing nature of employment (Sauter et al., 2002; WHO, 2005).

Key changes in the nature of employment include:

- The rise in self-employment (rising from 12% of all employed people in 2000 to 15% in 2017; ONS, 2016).
- The ‘gig economy’ (short term engagements, or a number of small separate pieces of work) including online gig work (paid work allocated and delivered via internet platforms).
- Increased work intensity or work acceleration (a social change more broadly described by Rosa (2003) as an acceleration of technology, social change and pace).
- Globalisation.
- An increase in the number of women working.
- An increase in the number of older workers.
- An increase in homeworking and part-time work.

Many of these factors can be regarded as positive opportunities, but if poorly managed may increase psychosocial hazards resulting in a negative impact on workplace health.

1.2.3 Psychosocial work hazards and the impact on health

Psychosocial hazards describe aspects of the design and management of work, and the social and organisational context of work that have the potential for causing psychological or physical harm (Leka & Cox, 2008), including: job content, workload and work pace, work schedule, control, environment and equipment, organisational

culture and function, interpersonal relationships at work, role in the organisation, career development, and home-work interface (Leka & Cox, 2008). Adverse psychosocial work characteristics are significant predictors of mental and physical health problems including the onset of subclinical and clinical anxiety and depression (Andrea, Bültmann, Ludovic, van Amelsvoort & Kant, 2009; Bonde, 2008; Levi, 2005; Netterstrøm et al., 2008; Niedhammer, Goldberg, Leclerc, Bugel & David, 1998; Schmidt, Roesler, Kusserow & Rau, 2012; Stansfeld & Candy, 2006; Tennant, 2001; Theorell et al., 2015; Wang, 2005), stress related disorders (Nieuwenhuijsen, Bruinvels, & Frings-Dresen, 2010), cardiovascular disease (Landsbergis et al., 2011) musculoskeletal disorders (Bugajska et al., 2013; Yang et al., 2016), and in women, type 2 diabetes (Heraclides, Chandola, Witte, & Brunner, 2009; Sui et al., 2016). A recent meta-review of the evidence linking work to the development of common mental health problems (Harvey et al., 2017) reported evidence that imbalanced job design, occupational uncertainty and lack of value and respect in the workplace may contribute to the development of depression and or anxiety; these concepts are illustrated in Figure 1.1 below. Based on these findings, the authors proposed a unifying model of workplace risk factors (see Figure 1.1).

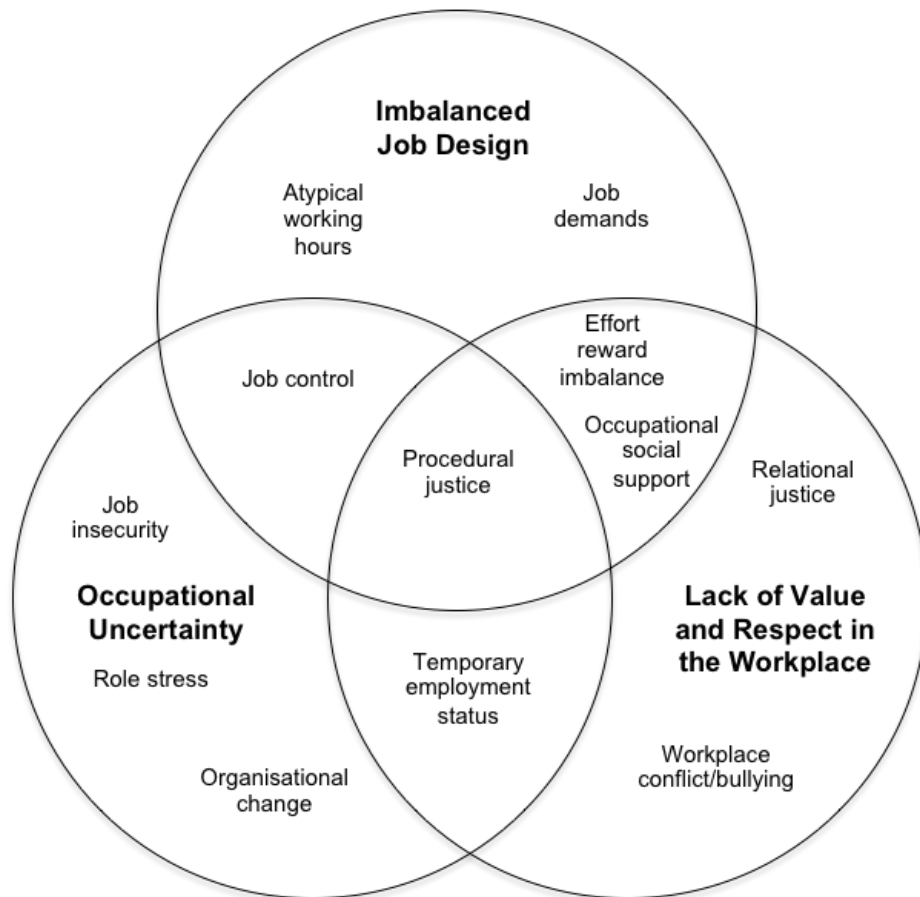


Figure 1.1: Unifying model of workplace risk factors (Harvey et al., 2017)

1.2.4 Common mental health problems and workplace performance

Common mental health problems such as stress, depression and anxiety can result in cognitive impairments (for a review see Castaneda, Tuulio-Henriksson, Marttunen, Suvisaari, & Lönnqvist, 2008; Gold, Montana, Sylvia, Nierenberg, & Deckersbach, 2016; Lee, Hermens, Porter, Redoblado-Hodge, 2012) and cognitive biases (Gold et al., 2016), with increased depression severity being shown to result in decreased performance in episodic memory, executive function and processing speed (McDermott & Ebmeier, 2009). Studies have shown the impact that these impairments can have on workplace performance: in a study of nurses working at a telephone helpline, Allan et al. (2013) found that higher levels of occupational stress were associated with failures in attention, memory and concentration and that the nurses most affected made more conservative decisions; and in a study based in a UK call centre, Harvey et al. (2011) concluded that work groups with higher levels of depressive symptoms had poorer work

performance. In one qualitative study, employees with personal experience of anxiety or depression taking part in focus groups reported that the physical and psychological symptoms of anxiety and depression and the side-effects of medication, impaired work performance and increased the risk of accidents (Haslam, Atkinson, Brown, & Haslam, 2005). In a 2016 CIPD survey, employees experiencing poor mental health who continued to attend work reported the ways in which their condition affected their work performance, this has been shown below in Figure 1.2. Only 4% of people who responded to the survey didn't feel that their mental health problem affected their work at all.

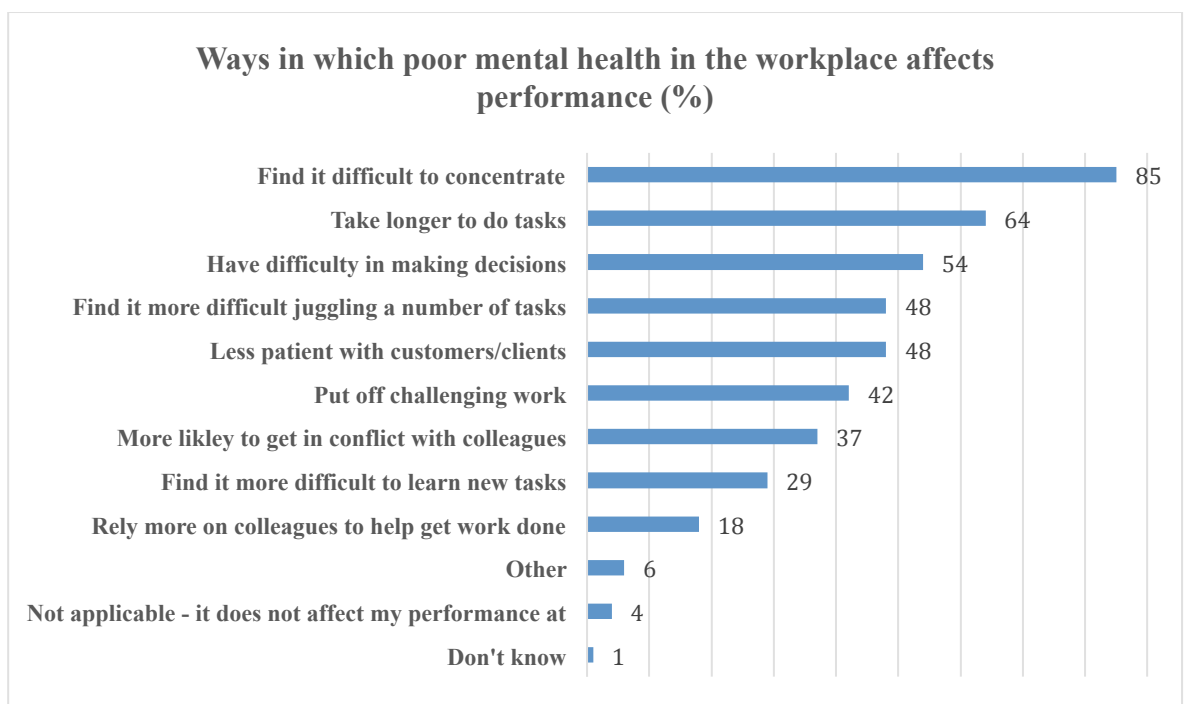


Figure 1.2: Impact of poor mental health on workplace performance. (Adapted from CIPD, 2016)

1.3 The conceptualisation of occupational stress

1.3.1 Stress as a problematic concept

Psychological stress as a concept is problematic (see Doublet, 1999; Le Ferve & Kolt, 2010; Wainwright & Calnan, 2002), the definition of ‘stress’ is amorphous, it can describe both:

- A positive and a negative state;
- A physiological and a psychological phenomenon;
- A state and a process; and
- A stimulus and a response.

But, all conceptualisations agree that stress is a psychological phenomenon and not (just) the situation/challenge/threat.

Stress is not a formally recognised medical condition: there are no criteria for diagnosis, but research shows that prolonged exposure to stress is linked to physical and psychological ill health (see section 1.2.3 for an overview of the research).

The term stress is often used to describe any mental health problem that is perceived to be caused by work: a recent example of this is a footballer who after being sectioned under the mental health act was described by his employer as having a ‘stress-related illness’ (BBC 2017). It has been argued that the language of stress can be used for political gain: in their cultural theory of stress complaints, Barley and Knight (1994) suggested that stress claims are used as an organising rhetoric by unions and semi-professions such as social work, nursing and teaching to build solidarity and collective action:

Claims of stress may be used to galvanize a sense of consciousness and solidarity among an occupation's members. Moreover, by repeatedly proclaiming exposure to stressful work, an occupation may construct a publicly credible rationale for why it should be allowed such privileges as higher pay and the right to self-regulate. (p19)

The authors argue that semi-professional groups are more likely to claim experience of work-related stress, as they do not have the power of full professionals (e.g. doctors and lawyers) to dictate the terms and conditions of their work. Wainwright and Calnan

(2002) make a similar argument, suggesting that following the Thatcher government's assault on trade union power in the 1980s, trade unions moved from collective bargaining to using the medicalised prism of health and safety at work to change the workplace. The concept of stress was essential to this transformation. Barley and Knight (1992) also argue that stress is contagious; that through the process of interpretive contagion, individuals are more likely to use the language of stress to make sense of their experiences when their colleagues also use the same language. These issues of definition and usage affect our ability to understand, measure and research stress, and affect our ability to develop theory.

The phenomena of stress are too broad and complex to be adequately described by a single model. Below are a number of examples of theories and models of stress that have played a prominent role or have been influential in our conceptualisation, research and subsequent treatment of the phenomena. The first three: the physiological models of stress, the type A model of stress, and the transactional model of stress offer generic explanations of stress, whereas the following three: person – environment fit, effort-reward imbalance, and job demand – job control, are (more) work-specific.

1.3.2 Generic models of stress

Physiological models of stress

Theories of stress begin with the work of Canon (1925) and Seyle (1936). They are often described as the 'fathers of stress'. Both were writing about stress from a physiological perspective. At the core of their work was the concept of homeostasis – the body's attempt to maintain a steady equilibrium despite challenges. Cannon wrote about the fight or flight response to stress, which explained the physiological changes that take place in a stressed body (Cannon, 1925) and Seyle wrote about the General Adaptation Syndrome (GAS), a three-stage process of physiological adaptation (Seyle, 1936). Both describe the consequences of an external (physical) stressor disturbing an individual's natural homeostatic balance. Research has suggested that contrary to this approach, responses to stimuli do not always follow the same pattern (Cooper, Dewe & O'Driscoll, 2001). Other criticism includes that the models do not take into account the psychological response to stress (Cooper et al., 2001), and Seyle's conceptualisation of stress has been criticised for not taking into consideration the cognition, perception, and

the interpretation of the stimulus (Hill-Rice, 2012; Mason, 1971). Christian and Lolas (1985) suggest that stress as described by Seyle is still relevant for some stressors (e.g. the physical factors such as infection, heat, cold, noise), but it is not adequate to explain the psychosocial aspects of stress. The psychosocial concept of stress that we understand today did not enter the scientific lexicon until after the Second World War (Wainwright & Calnan, 2002).

Type A personality model

Two cardiologists, Friedman and Rosenman (1974) identified a significant relationship between behavioural patterns of people and their susceptibility to stress-related illness, particularly coronary heart disease. They proposed a model that depicts stress as being moderated by personality. People with type A behaviour exhibit extremes of ambition, aggression, impatience, hyperalertness, competitiveness, and eagerness to get things done. People with type B behaviour are more relaxed and less competitive. The model suggests that people exhibiting type A behaviour are more likely to select themselves into a high demand job, but are also more likely to over-react to them, and are therefore more vulnerable to stress and coronary heart disease (Wainwright & Calnan, 2002). Type A behavioural pattern has been described as a ‘cultural-bound syndrome’ mainly involving middle-aged, middle-class, North American businessmen (Helman, 1987). One large-scale study of British men concluded that type A behaviour did not predict major ischaemic heart disease events, and that contrary to the model, there was a trend towards higher heart disease rates for type B men (Johnston, Cook & Shaper 1987). While there is little empirical evidence to support this model, it has been influential in introducing the notion of ‘executive stress’ into the public lexicon (Wainwright & Calnan, 2002).

The transactional model of stress

The transactional model of stress depicts undesirable environmental demands (including work stressors) as creating stressors; when people perceive that they do not have the ability to cope they then experience symptoms of stress that lead to physical and psychological illness. Figure 1.3 shows Payne’s (1999) depiction of this approach, which is heavily influenced by the work of Lazarus and Folkman (1984). Lazarus and Folkman’s (1984) transactional model of stress suggests that stress does not exist within the individual or the environment on its own but as a subjective process that is

cognitively determined. Stress occurs when environmental demands or constraints are judged by the individual as exceeding his or her resources or capacity to cope. It is the appraisal by the individual of their ability to cope with the demands that determines whether the situation is experienced as a stressor. If they perceive themselves as having the time, the support, the skills, and the knowledge to manage the situation, then the positive coping leads to psychological and physical benefits or eustress. Eustress describes the positive consequences of stress: where we become totally engaged in our task, where distractions are screened out, time suspends and we feel energised, hopeful, committed and satisfied (Nelson & Simmons, 2014). The holistic model of stress (Nelson and Simmons, 2014) suggests that most, if not all stress responses elicit both a degree of negative and a degree of positive response.

Criticism of the transactional model of stress when applied to the work setting is that the model argues that stress occurs at an individual level and does not focus on work conditions. It has been suggested that work stress researchers should focus on situational and structural variables (Dewe, 1997), and that their time may be spent more effectively creating a taxonomy of stressful job conditions that affect most workers (Cooper et al., 2001).

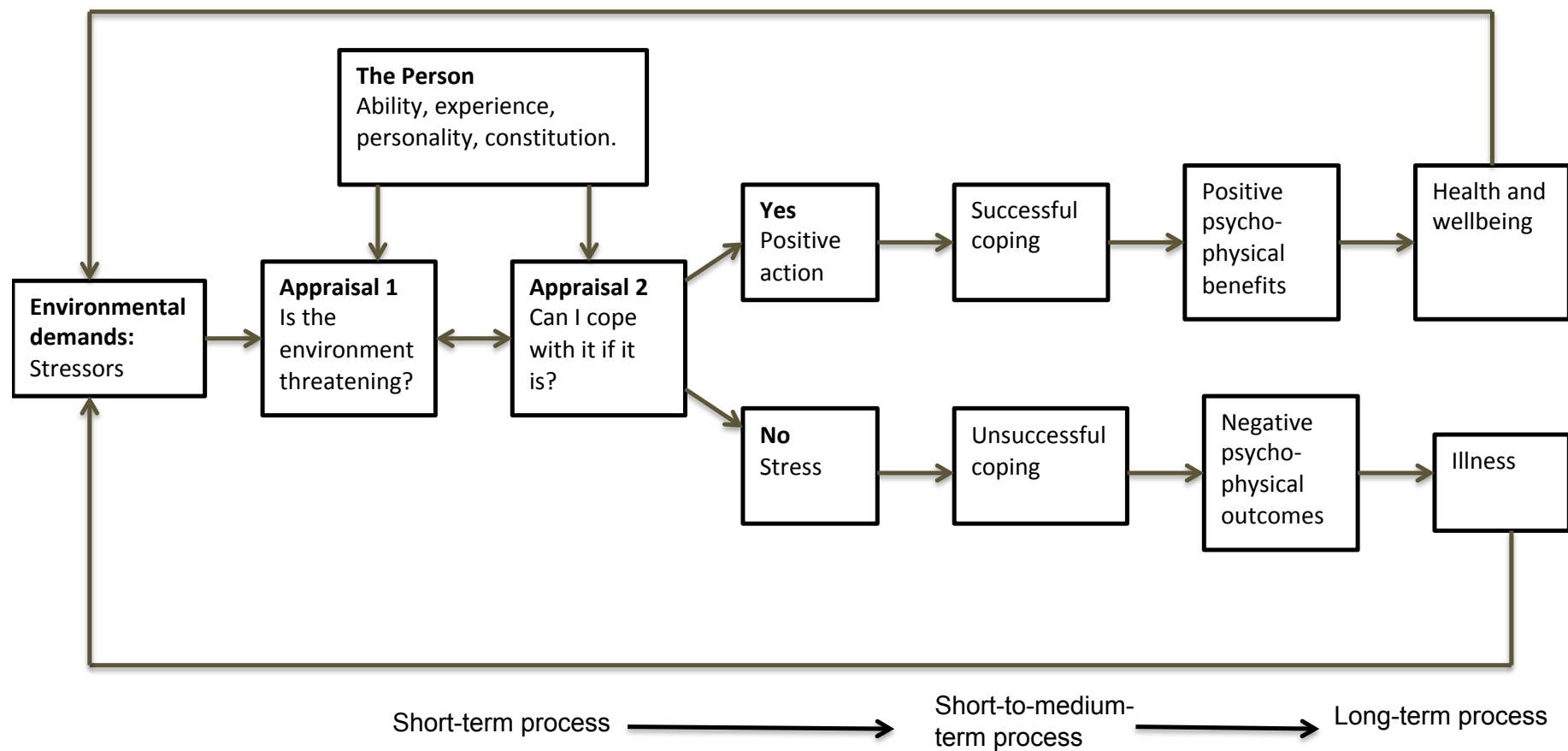


Figure 1.3: Stress as a process (Payne, 1999)

1.3.3 Work-specific models of stress

Person-environment fit

The person-environment (P-E) fit model of stress is a work stress theory. Early work on this model was conducted by French, Rogers and Cobb (1974) but this has been refined and developed by other researchers (e.g. Caplan, Cobb, French, Van Harrison & Pinneau, 1975). The core premise of the theory is that work stress arises from the lack of compatibility (or fit) between the work environment and the individual (for an overview see Edwards, Caplan & Harrison, 1998). Stress at work is caused by a lack of fit between (a) the outcomes or opportunities provided by the job, and the physical and psychological needs, values, preferences and motives of the worker, and (b) the requirements of the job, and the skills, knowledge, time, energy and abilities of the worker. The model differentiates between the objective and subjective person, and the objective and subjective environment. The objective person or environment refers to the individual or the environment, as they actually exist; and the subjective person or environment refers to the individual's perception of his or her attributes, and their perception of the situations or events that they encounter. The lack of fit is hypothesised to generate negative psychological, physiological and behavioural outcomes.

A number of criticisms have been made about the evidence supporting the P-E fit model; in a review of the literature, Edwards & Cooper (1990) suggested that empirical evidence for the approach is lacking, and that "studies are repeatedly plagued with serious theoretical and methodological problems which severely limit the conclusiveness of their findings" (p294). Edwards and Cooper (1990) identified a number of major shortcomings to the research, including inadequate distinction between functional forms of fit, inappropriate measures for the fit components, and inappropriate analysis of the effects of fit. Additionally, this model does not identify the characteristics of the workplace that lead to work stress.

Effort-reward imbalance

The Effort-Reward Imbalance (ERI) model developed by Siegrist (1996) takes as its starting point that work provides us with access to a social group (e.g., work colleagues), and to an identity, and it can be a source of self-esteem and self-efficacy.

These benefits are based on reciprocity of exchange where efforts are balanced by the respective rewards:

Effort at work is spent as part of a socially organized exchange process to which society at large contributes in terms of rewards. (Siegrist 1996, p29)

Rewards are distributed in three ways: money, esteem and status. When the expectation of reciprocity is violated (i.e. high cost and low gains) this leads to strong negative emotions. According to this model, it is an imbalance between efforts and rewards that leads to stress and ill health. Unlike the transactional, or the P-E model of stress, in the ERI model, the individual does not necessarily have to be consciously aware of the imbalance, or appraise the situation as stressful in order to be negatively affected by it.

A review of 45 empirical studies on ERI reported that the majority of studies support the hypothesis that a combination of high effort and low reward was associated with poor employee health (van Vegchel, de Jonge, Bosma & Schaufeli, 2005).

Job demand – job control model

The job demand – job control model (also known as the job strain model) is one of the most influential models of work stress. The model developed by Karasek (1979) predicts that stress results from an interaction between job demands (workload, time pressure, role conflict) and job decision latitude (skill discretion, decision authority); stress occurs when job demands are high and job control (decision latitude) is low (see Figure 1.4). The level of control moderates the impact of workload on wellbeing. The optimum job is when control is high and job demands are high. This “active job” leads to learning and development whereas the opposite “passive job” leads to a reduction in activity and problem solving. Karasek (1979) reported that more “active jobs” are associated with greater satisfaction and reduced depression, whereas “passive jobs” lead to lower satisfaction. The model was updated by Karasek and Theorell (1990) to include social support as another critical factor in moderating the impact of job demands. Social support describes the extent to which individuals can get emotional and/or material support and advice from their co-workers or supervisors. High social support moderates the negative impact of high job demands.

The model postulates two hypotheses: the strain hypothesis and the buffer hypothesis (Häusser, Mojzisch, Niesel & Schulz-Hardt, 2010). The strain hypothesis predicts that

wellbeing is low in high strain jobs and that this can be the result of both additive and multiplicative effects of job demands and control (high strain and low control jobs may in themselves affect wellbeing, the suggestion here is that the combination of the variables has an effect on wellbeing which is greater than their additive effect); and the buffer hypothesis refers to the interactive effect of demands and control where control is predicted to buffer the negative impact of job demands (Häusser, Mojzisch, Niesel, & Schulz-Hardt, 2010).

Support for Karasek's job demand – job control model has been inconsistent (Sargent & Terry, 2000). A longitudinal study of job characteristics and worker stress found no evidence for the multiplicative effect of control and job demands on stress (Carayon, 1993), and a review of 83 studies published between 1998 and 2007 concluded that there is evidence for the additive effects of demand, control and social support on general psychological wellbeing, but only weak empirical support for multiplicative effects; support for the buffering hypothesis was very weak (Häusser et al., 2010). The model has been criticised for being over simplistic and focusing on too few variables that are too broadly defined (Jones, Bright, Searle & Cooper, 1998); the authors also suggest that it forms the basis of a job design intervention to improve wellbeing, rather than providing a full description of the psychosocial dimensions of work life.

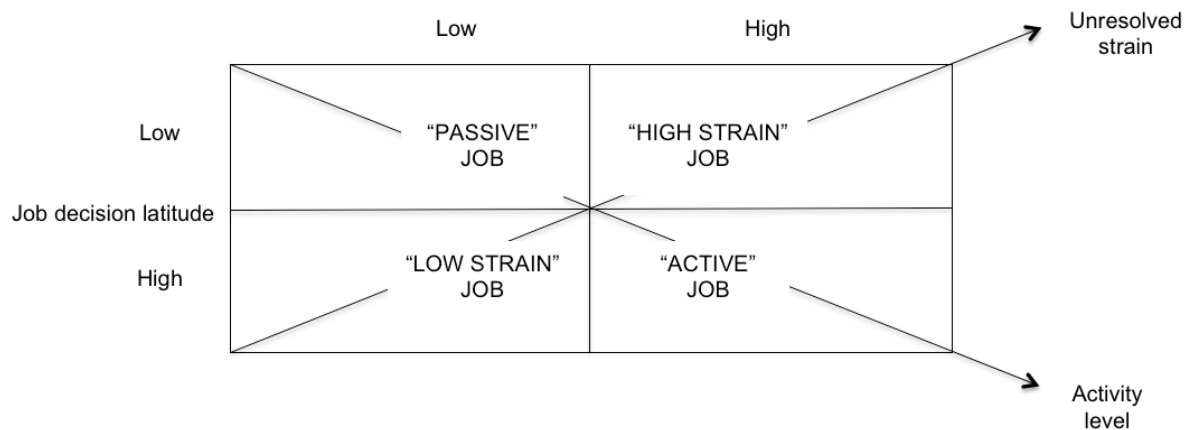


Figure 1.4: Job strain model (Karasek 1979)

1.3.4 *Summary and conceptualisation of stress in this thesis*

In this chapter I have described six models of stress: three of the models were (predominantly) generic models of stress, and three were (predominantly) work models of stress. The generic models of stress described in this chapter include stress as a physiological response to stimuli (Canon's fight or flight response, and Seyle's physiological adaptation); stress moderated by personality (Freidman and Rosenman's type A personality model); and stress as a transactional process: stress doesn't sit wholly with the individual or with the environment but in the relationship between the two. The work models of stress described in this chapter include another transactional model: stress occurs when there is a mismatch between the individual and the environment (the P-E Fit model); stress as an imbalance between the efforts made and the rewards received (Siegrist's ERI model of stress); and stress as an interaction between job demands and job control (Karasek's job demand - job control model).

In this programme of research, I am conceptualising stress as described by the transactional model of stress: stress as a subjective process that is cognitively determined. Central to this approach is the idea that stress is a dynamic cognitive state (Cooper et al., 2001). Digital mental health interventions are used to influence the cognitive appraisal and coping that follows a stressful encounter. It is important to note that this approach does not suggest that stress sits wholly within the individual; it is seen as being part of a transaction. Stress is:

Embedded in an ongoing process that involves individuals transacting with their environments, making appraisals of those encounters, and attempting to cope with the issues that arise. (Cooper et al., 2001. p9)

Digital mental health interventions aim to reduce or prevent psychological distress by supporting the adaptive capabilities of individuals, influencing their cognitive appraisal of potentially stressful situations, and providing the tools to increase their (perceived and actual) ability to cope.

1.4 Stress management interventions at an individual and an organisational level

The way that we conceive of stress influences the interventions that are developed and delivered: whether the intervention is aimed at the individual, the organisation, or both. In an early reflection on workplace stress, DeFrank and Cooper (1987) identified three levels of stress management intervention and outcomes: individual, individual/organisation interface, and organisation (see Table 1.1). The first level focuses on the individual and how she/he responds to and copes with stress. The second level focuses on the interaction between the individual and the organisation, this includes characteristics of the role, and the third level focuses on the organisational environment, structure and policies. The individual level identifies interventions aimed at how people physically (e.g. relaxation techniques, biofeedback, meditation) and cognitively (cognitive restructuring) respond to stress, and how they organise their world (time management), whereas the individual/organisation interface level and the organisation level both focus on factors believed to produce stress such as relationships and roles (interface level), and structure and training (organisation level). The digital mental health interventions that are reported on in this thesis are aimed at the individual level of stress management. This is for two reasons. Firstly, there is better support for the efficacy of individual level interventions: a synthesis of the evidence for individual, organisational and mixed interventions on mental health and absenteeism reported that individual level interventions (predominantly cognitive behaviour therapy) had a greater effect on individual outcomes compared with organisational and interface level interventions (Bhui, Dinos, Stansfield & White, 2012); and secondly, there are only a few digital interventions that have been developed to target employee wellbeing at an organisational or organisational/individual interface level, (Ryan, Bergin, Chalder & Well, 2017).

Table 1.1: Levels of stress management interventions and outcomes (DeFrank & Cooper, 1987)

Interventions	Outcomes
Focus on individual: <ul style="list-style-type: none"> • Relaxation techniques • Cognitive coping strategies • Biofeedback • Meditation • Exercise • Employee Assistance Programmes • Time management 	Focus on individual: <ul style="list-style-type: none"> • Mood states (depression, anxiety) • Psychosomatic complaints • Subjectively-experienced stress • Physiological parameters (blood pressure, catecholamines, muscle tension) • Sleep disturbances • Life satisfaction
Focus on individual/organisation interface: <ul style="list-style-type: none"> • Relationships at work • Person-environment fit • Role issues • Participation and autonomy 	Focus on individual/organisation interface: <ul style="list-style-type: none"> • Job stress • Job satisfaction • Burnout • Productivity and performance • Absenteeism • Turnover • Health care utilisation and claims
Focus on organisation: <ul style="list-style-type: none"> • Organisational structure • Selection and placement • Training • Physical and environmental characteristics of job • Health concerns and resources • Job rotation 	Focus on organisation: <ul style="list-style-type: none"> • Productivity • Turnover • Absenteeism • Health care claims • Recruitment/retention success

1.5 Preventative stress management

As well as targeting interventions at an individual or organisational level, stress interventions can be delivered at three different time points. Quick and Quick (1979) introduced a theory of preventative stress management, which translated the principles of public health prevention into an organisational stress context (Figure 1.5). They identified three stages of stress prevention and intervention: primary, secondary and tertiary. Primary prevention is aimed at reducing the physical and psychological stressors that trigger an extreme stress response in individuals, secondary prevention aims to moderate the stress response and tertiary prevention moderates the behavioural, psychological and medical consequences associated with distress (examples include substance abuse, bullying, anxiety disorders, depression, sleep disturbance, heart disease and stroke). The digital mental health interventions that are reported on in this thesis are secondary and tertiary interventions. This is because primary prevention interventions are proactive and seek to prevent exposure to a known risk factor, and are therefore likely to be aimed at an organisational or an organisational/interface level. Secondary prevention aims to identify and treat individuals at risk of developing problems, and tertiary interventions aim to treat and manage existing stress-related conditions and limit their impact; both of these stages are aimed at the individual level targeted by the digital health interventions reported on in this thesis.

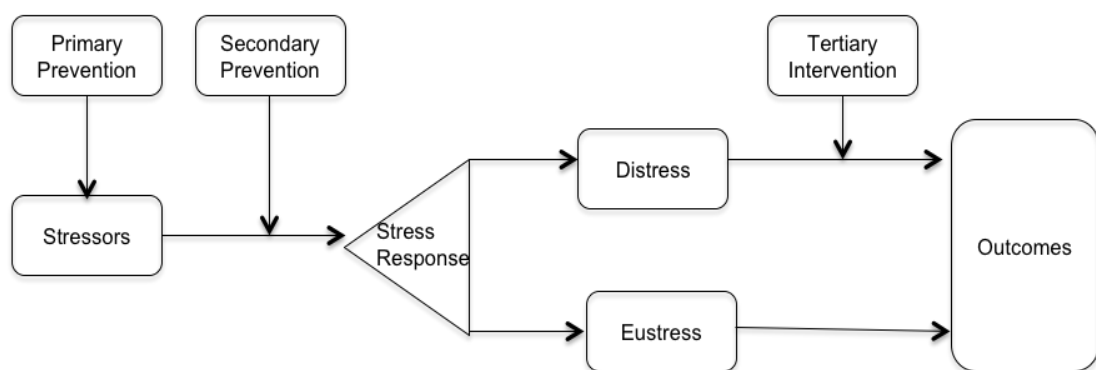


Figure 1.5: Preventative stress management model (Hargrove et al., 2011)

1.6 Addressing mental health in the workplace

1.6.1 Mental health as a workplace issue

In the UK, mental health is fairly well established as a workplace issue. In countries such as the USA where employers fund healthcare, the focus has been more on reducing health service use through preventative measures to reduce the financial burden of chronic physical diseases, whereas in the UK where healthcare is state funded the focus has been on reducing direct costs to the employer which includes sickness absence and presenteeism (Litchfield, Cooper, Hancock, & Watt, 2016). Employers are increasingly aware of the link between work and mental health, with 75% of public sector employers and 48% of private sector employers agreeing that there was a strong link (Young & Bhaumik, 2011). They are also aware of the cost that poor mental health imposes on them in terms of impaired work performance, staff turnover and absenteeism, but only 56% of employers agree that the financial benefits of spending money on employee health and wellbeing outweigh the cost, and 51% think that their employees would not want them to intervene in their physical or mental health (Young & Bhaumik, 2011). Stigma and lack of understanding about people who experience poor mental health is still high: only 57% of employers recognise mental illness as a disability under the Disability Discrimination Act (now the Equality Act; Dewson et al., 2009) and only 44% of respondents to a survey of over 2000 employees said that they would be very or fairly comfortable with someone with a mental health condition being their boss (Staniland, 2011).

1.6.2 Employers' mental health knowledge and expertise

Many employers - especially small and medium sized employers - are unsure how to address mental health problems in the workplace (Dewson et al., 2009), and don't have access to specialist services. A review by the HSE (2002) reported that between 3% and 15% of UK companies provide occupational health support (the variance is based on the definition of occupational health support that is used), although this report is dated, HSE continue to emphasise the limited access to occupational health support in their current occupational health priority planning which is available on their website (e.g. HSE no date, Occupational Health: The Priorities). Even when the support is provided,

occupational healthcare workers often have less knowledge about mental health problems than they do about physical health problems (Lelliott et al., 2008), and only one in ten UK employers use more specialist expertise such as psychologists, compared with 50-60% of employers in Sweden, Denmark and Finland (OECD, 2014).

This lack of knowledge and expertise is notable given that the workplace has been identified as an important location for the delivery of health promotion and intervention programmes aimed at preventing and treating common mental health problems (Hammer, Liebherr, Kersten & Hass, 2015; Mykletun and Harvey, 2012; OECD, 2014; Sanderson & Andrews, 2006; Tan et al., 2014). One of the reasons for this appeal is the potential to reach a large number of people; in the UK in 2017, 75.2% of people between the ages of 16 and 64 were in work (ONS, 2018), with full-time workers working on average 39.1 paid hours per week (ONS, 2017).

1.6.3 Treating common mental health problems in the workplace

There is evidence that common mental health conditions can be successfully prevented and treated in the workplace (Bhui, et al., 2012; Corbière, Shen, Rouleau & Dewa, 2009; Joyce et al., 2016; Martin, Sanderson, & Cocker, 2009; Lexis et al., 2011; Meyers, van Woerkom, & Bakker, 2013; Richardson and Rothstein, 2008; Tan et al., 2014; Vanhove, Herian, Perez, Harms, & Lester, 2015). A systematic review and meta-analysis (Tan et al., 2014) concluded that there was good quality evidence that workplace mental health interventions can reduce the level of depression symptoms in workers. The pooled mean effect size for the nine randomised controlled studies included in the review was 0.16 (95% CI: 0.07, 0.24, $p = 0.0002$), which is regarded as a small effect size using Cohen's (1988) classification of magnitude of effect size.

Five of the studies included in the review were cognitive behavioural therapy (CBT) based. CBT describes a form of psychotherapy that is based on the idea that the way that we think about things affects how we feel emotionally and how we then behave. It is used to treat people with a wide range of mental health problems. All of the studies in the review involved face-to-face interactive training and some form of health education. Eight of the studies included interventions that were delivered over multiple sessions,

and most encouraged participants to complete homework. One study provided individual feedback via email. None of the interventions described were digital.

In a systematic meta-review of work-related mental health interventions for anxiety and depression, Joyce et al., (2016) identified 20 reviews that met their inclusion criteria; the reviews were divided into primary, secondary and tertiary interventions. Moderate level evidence was found for two primary prevention interventions: increasing employee control and promoting physical activity. Strong evidence was found for both CBT based stress management as a secondary intervention and CBT as a tertiary intervention. It is unclear whether any of the 481 studies included in the 20 reviews used interventions that were digital. A meta-review of stress management interventions delivered in the workplace, which included 23 systematic reviews representing 499 studies, also found a stronger evidence for CBT based interventions compared with other stress management interventions (Bhui et al., 2012).

However, despite the prevalence of common mental health problems including stress in the workplace, and despite the evidence that mental health interventions can be effective when delivered in the workplace, take-up of psychological treatments by employees is low (Dewa & Hoch, 2015; Dewa et al., 2011; Lim, Sanderson & Andrews, 2000). The result is that many depressed workers go untreated or inadequately treated (Birnbaum et al., 2010; Wang et al., 2007).

1.7 Low take-up of mental health interventions amongst employees

Help seeking for mental health problems within the working population has been reported as being between 15% (Lim et al., 2000) and 43% (Dewa et al., 2011), which is similar to help seeking amongst the general population. In England, 39% of the general population who meet the diagnostic criteria for at least one common mental health condition, and 55% who meet the diagnostic criteria for depression, report that they are receiving treatment (McManus, Beddington, Jenkins & Brugha, 2016). Treatment rates in the US are similar; in 2016, 43% of adults with any mental illness and 65% with serious mental illness received treatment (SAMHSA, 2017).

Three types of barriers to mental health service use have been identified by Mojtabai et al., (2011). These barriers are: 1) low perceived need for treatment, 2) attitudinal/evaluative barriers (stigma, negative experience with providers, perceived ineffectiveness of treatment, wanting to manage things independently), and 3) structural barriers (prohibitive cost, inconvenient location, inability to get an appointment). Low perceived need for treatment was also identified as the main barrier to workers accessing services in a survey of mental health service use amongst workers in Canada (Dewa & Hoch, 2015): the study reported that 53% of workers with depression did not recognise a need for treatment, 6% experienced an attitudinal barrier, and 5% experienced a structural barrier. Stigma of mental illness has been shown to impede help seeking among people who experience mental health problems (Clement, et al., 2014; Corrigan, Druss & Perlick, 2014; Mojtabai et al., 2011). It is also a barrier for many workers who experience mental health problems, with workers in one study reporting that they felt stigmatised and were reluctant to tell people at work about their illness (Haslam et al., 2005). Six different types of stigma were identified in a review by Clement et al. (2014): anticipated stigma (anticipation that you will be perceived or treated unfairly); experienced stigma (personal experience of being perceived or treated unfairly); internalised stigma (holding stigmatising views about yourself); perceived stigma (individual's perception about the extent to which other people have stigmatising attitudes/behaviours towards other people who experience mental illness); stigma endorsement (individual's own stigmatising attitude/behaviour towards other people); and treatment stigma (the stigma associated with seeking or receiving treatment for mental illness).

One way to address the barriers to mental health service use amongst workers may be by providing access to evidence-based interventions through the use of the Internet via a web browser or an Internet application (app). Low perceived need for treatment, attitudinal/evaluative barriers, and structural barriers may be addressed by making interventions more readily available without the need for making or attending appointments or speaking to a health service professional for a referral. This could be done through the delivery of digital mental health interventions.

1.8 Advantages and disadvantages of digital interventions

Digital mental health interventions can be delivered as standalone treatments or as adjuncts to face-to-face therapy. They can deliver time-consuming aspects of treatment such as psycho-education, they can deliver in-between session exercises, and they can deliver post-treatment interventions to help maintain treatment gains and prevent relapse and recurrence (Ebert, Cuijpers, Muñoz & Baumeister, 2017). Numerous benefits have been stated for the digital delivery of therapeutic programmes, including the ability to deliver anonymous (Brouwer et al., 2011; Norman et al., 2007; Bennett & Glasgow, 2009), tailored interventions (Brouwer et al., 2011; Norman et al., 2007) that can have the potential to reach a large number of people at a lower cost compared with face-to-face interventions (Dunkl & Jimenez, 2017; Kazdin, 2015; Marcus, Nigg, Riebe, & Forsyth, 2000), that they can transcend space and time (Ebert, Cuijpers et al., 2017), and can be worked through at the users' own pace (Brouwer et al., 2011; Kohl, Crutzen, & de Vries, 2013). Digital interventions may not require (or may reduce) the need for mental health professional staff (Kazdin, 2015), they can be delivered outside of traditional treatment settings and may therefore be able to provide us with the potential to reach populations who otherwise would not receive treatment (Spek et al., 2007), they can be graphically rich and engaging and make use of interactive tools (Bennett & Glasgow, 2009), they can be designed as games to make them more appealing (Norman et al., 2007), and they can provide instant feedback and support (Dunkl & Jimenez, 2017). The ability to access digital interventions without having to attend an appointment at a health clinic means that they can appear relatively free of the stigma often attached to traditional mental health services (Lui, Marcus and Barry, 2017), and there is evidence that the very form of on-line interventions can promote agency, mastery, control and learned resourcefulness (Kaltenthaler & Cavanagh, 2010).

It has also been suggested that the convenience and portability of digital interventions that are delivered on mobile technology (e.g. smart phones, tablets, wearable devices) mean that interventions can be delivered “in the moment of need” during high risk or triggering situations (Lui et al., 2017).

It must be noted, however, that the objective evidence for these claims is not always clear. In a review of the evidence that health information technologies can expand

access to mental health care and reduce disparities in the use of services, Clarke & Yarborough (2013), argue that there is little robust evidence to support these claims. This is a view supported by Kohl et al. (2013) in a systematic review of the reach, effectiveness and use of Internet-delivered interventions aimed at lifestyle behaviours. Kohl et al. (2013) identified 41 relevant reviews (almost half of which were weight management programmes). They observed that while the potential reach of digital interventions is virtually universal, their review found that actual reach was undiversified; mostly female, Caucasian and highly educated.

The possible disadvantages of digital interventions include concerns about data protection, and privacy and confidentiality. This is because data may be vulnerable to being obtained by unauthorised individuals through data theft, or through the lack of encryption or the physical loss of the device (Lui et al., 2017). Concern has also been expressed that for many of the digital interventions that are commercially available, there is a lack of evidence of their clinical effectiveness and that it can be difficult for members of the public to assess their credibility and reliability (Leigh & Flatt, 2015; Lui, et al., 2017; Shen et al., 2015). Another disadvantage of digital mental health interventions might be the loss of the therapeutic relationship between the therapist and the client. This collaborative bond has been identified as having a significant effect on therapeutic outcome (Krupnick et al., 1996) and may account for up to 30% of the variance in client outcome (Lambert & Barley 2001). It is also possible that the dilution or loss of the therapeutic relationship in digital therapies may influence the level of engagement with the intervention (Cavanagh & Millings, 2013).

However, despite these concerns and despite us not having fully utilised the full scope of the Internet and technology to expand, increase and enhance the reach and efficacy of therapeutic programmes, the potential benefits of the digital delivery of therapeutic interventions are clear and exciting.

1.9 Internet use

People are increasingly turning to the Internet to access healthcare information and treatment (Strecher, 2007; Tustin, 2010). In 2017, 95% of the population in North

America and 85% in Europe had Internet access (www.internetworldstats.com). In the UK, 95% of the population had Internet access (www.internetworldstats.com), with 88% of adults using the Internet every week, and 78% of adults accessing the Internet “on the go” using a mobile or smartphone, portable computer or other handheld device (ONS, Aug 2017). In the UK, even for populations who we may perceive as being at higher risk of digital exclusion, studies suggest that digital exclusion is low: a review of the use of technology by individuals with serious mental health problems found that digital exclusion was declining and that those most likely to be excluded were long time users of psychosis services, and older people (Robotham, Satkunanathan, Doughty, & Wykes 2016). It is worth noting however, that while Internet use is high in North America and Europe, statistics for Internet use in other parts of the world are lower: 35% of the population in Africa, 48% in Asia, and 67% in Latin America have access to the Internet (www.internetworldstats.com).

1.10 Definitions

1.10.1 Internet interventions and apps

A large number of different terms have been used to describe similar treatments including e-health, m-health, mobile mental health, e-therapy, computerised CBT (cCBT), Internet delivered CBT (ICBT), web-based treatments, Internet treatments, digital interventions, and online treatments amongst others (Barak, Klein & Proudfoot, 2009; Andersson, 2016). For the purposes of this thesis, I have chosen to distinguish between interventions delivered predominantly via a web-browser (Internet interventions) and interventions delivered via mobile and wireless applications (mobile technology e.g. apps, wearable devices, remote sensing). I have made this distinction because the interventions currently described in academic literature are predominantly Internet interventions. One reason for this is the time delay between interventions being developed, research being conducted, and the research being published. The literature on e-health and apps is more nascent (Lui et al., 2017) and as such, does not have the level of evidence that is available for Internet interventions. When describing both Internet interventions and mobile technology I have used the term ‘digital intervention’.

1.10.2 Differentiating between adherence, exposure and engagement

The focus of this thesis is on increasing adherence to digital mental health interventions delivered in the workplace. One of the challenges to researching in this field is finding a common language; the usage of the terms adherence, exposure and engagement varies considerably (Cavanagh, 2014; Mohr, Burns, Schueller & Clarke, 2013; Perski, Blandford, West & Michie 2017; Yardley et al., 2016). The WHO defines adherence as “the extent to which a person’s behaviour – taking medication, following a diet, and/or executing lifestyle changes, corresponds with agreed recommendations from a health care provider” (Sabaté, 2003; p3). Adherence differs from other terms used to describe the use of digital interventions in the literature such as exposure or engagement. Exposure is described as “accessing the intervention website and actually using it” (Crutzen et al., 2011; p50); objective measures of exposure include the number of times the user logged on to the program, the number of pages that were visited, the number of modules completed, and the length of the visit duration (Brouwer et al., 2011). User engagement with online environments have been described as both usage, and as the subjective experience of flow (Perski et al., 2017). Flow describes a state of absolute concentration and absorption (Csikszentmihalyi, 1990). Perski et al. (2017) merge both these descriptions to describe engagement with digital interventions as: “1) the extent (e.g. amount, frequency, duration, depth) of usage and 2) a subjective experience characterised by attention, interest and affect.” Definitions for both exposure and engagement don’t include the concept of a recommended intended usage that we see in the WHO definition for adherence.

Sieverink, Kelders and van Gemert-Pijnen (2017), suggest that adherence to digital interventions is an underdeveloped concept. Within the pharmaceutical industry, dosage of medication can vary depending on the severity of the condition and the patient’s characteristics (e.g. age, gender and weight). In contrast, with digital health interventions, it is often assumed that users should experience the same amount of an intervention to get an effect. In their review of the literature Sieverink et al. (2017) concluded that studies of digital health interventions often operationalise intended use as “the more use, the better”, and where they do provide a threshold of adherence, a justification for that threshold is often missing. Writing about engagement with digital health interventions, Yardley et al (2016) suggest that we need to move away from the

idea of promoting sustained engagement with these interventions, to promoting effective engagement, and that more engagement does not necessarily mean more effective engagement.

Adherence, exposure and engagement are used interchangeably throughout the research literature. Where possible in this thesis, I have made the distinction between these terms as described here; this is not always possible though. Sometimes muddled usage of the terms reflect the usage from the studies I am referring to, sometimes it reflects the difference between engage as a verb and adhere as an end point (someone engages with an intervention in order to adhere), and sometimes it reflects my own emerging understanding of how these terms differ.

1.11 Evidence for Internet delivered psychological therapies

Internet delivered psychological treatments have been found to be effective for both psychological and somatic conditions in over 100 controlled trials (Andersson, 2016). Meta-analyses and systematic reviews have found evidence for the effectiveness of these interventions for people experiencing common mental health problems including depression and anxiety (Andersson & Cuijpers, 2009; Andrews, Cuijpers, Craske, McEvoy & Titov, 2010; Cuijpers et al., 2009; Grist & Cavanagh, 2013; Mewton, Smith, Rossouw & Andrews, 2014; Richards and Richardson, 2012; Spek et al., 2007) and stress (Heber et al., 2017). Reviews of somatic conditions include chronic pain and headache (Buhrman, Gordh & Andersson, 2016), tinnitus (Andersson, 2015b), insomnia (Ritterband et al., 2009; Seyffert et al., 2016; Ye et al., 2016), cardiovascular disease (Aneni et al., 2014; Pietrzak, Cotea & Pullman, 2014), and diabetes (Angeles, Howard & Dolovich, 2011; Pal et al., 2014). There is also evidence that when delivered with some kind of support, guided Internet interventions can be as effective as face-to-face interventions (Andersson, Cuijpers, Carlbring, Riper & Hedman, 2014; Cuijpers, Donker, van Straten, Li & Andersson, 2010; Naidu, Giblin, Burke & Madan, 2015), and there is evidence that Internet interventions provide cost-effective access to treatment (Ebert, Kählke, et al., 2017; Solomon, Proudfoot, Clarke & Christensen, 2015; Thiart et al., 2016).

Yardley et al. (2016) describe engagement with a health intervention as a precondition for effectiveness, but one of the challenges to the effective delivery of Internet interventions is low engagement and adherence (Bennett & Glasgow, 2009; Brouwer et al., 2010; Cavanagh & Millings, 2013; Eysenbach, 2005; Kelders, Kok, Ossebaard & Van Gemert-Pijnen 2012; Kohl et al., 2013). A randomised trial comparing face-to-face cognitive behaviour therapy for panic disorder with a ten-module self-help Internet intervention, reported a completion rate (where participants completed all ten modules) for the face-to-face therapy of 88% compared with only 28% for the Internet intervention (Carlbring et al., 2005), and there is evidence that in real world settings, adherence to Internet self-help programs can be even lower than in trial settings (Christensen, Griffiths & Farrer, 2009; Wanner, Martin-Diener, Bauer, Braun-Faheländer & Martin, 2010). In a study comparing outcomes for trial participants of an Internet CBT program with members of the public who accessed the same free to use intervention, researchers reported that only 16% of the public completed two or more modules compared with 66% of trial participants (Christensen, Griffiths, Korten, Brittliffe, & Groves, 2004). Some Internet interventions that have been developed more recently are achieving good adherence (Ebert et al., 2016; Heber, Lehr, Ebert, Berking & Riper, 2016; Thiart, Lehr, Ebert, Berking & Riper, 2015; Umanodan, Shimazu, Minami, & Kawakami, 2014) but others are continuing to struggle, including those that are delivered within an occupational setting. A randomised controlled trial (RCT) of a digital mental health intervention delivered in the workplace reported that only 5% of participants started one or more of the modules (Bolier et al., 2014), and a trial of digital mindfulness delivered in a workplace reported that between 42% and 52% of all participants in the active conditions never logged on to the program (Allexandre et al., 2016).

Research has consistently shown that providing guidance from a therapist can lead to greater adherence to Internet interventions (Andersson & Cuijpers, 2009; Brouwer et al., 2011; Baumeister, Reichler, Munzinger, & Lin, 2014; Hilvert-Bruce, Rossouw, Wong, Sunderland & Andrews, 2012; Mohr, Cuijpers & Lehman, 2011), which increases the extent that users are exposed to the content of the intervention and may be an important determinant of effectiveness (Johansson & Andersson, 2012; Hilvert-Bruce et al., 2012), and a consistent predictor of positive outcomes (Bennett & Glasgow, 2009; Brouwer et al., 2011; Norman et al., 2007). A review by Johansson and

Andersson (2012) comparing outcomes for Internet interventions for the treatment of depression provided with and without support, reported that the greater the amount of support, the greater the effect size. It has been suggested however, that as digital health interventions develop and become more adaptive, persuasive, user friendly and enjoyable, the need for human facilitation may diminish (Yardley et al., 2016).

The evidence for the effectiveness of evidence-based digital interventions delivered within health and community contexts is convincing and compelling, but the evidence for digital interventions delivered in a workplace setting is less clear (Lehr et al., 2016). A number of reviews have focused on the delivery of psychological interventions in the workplace, but few if any of the included studies reported digital interventions (Vanhove, Herian, Perez, Harms & Lester, 2015; Martin, Sanderson & Cocker, 2009; Richardson & Rothstein, 2008; Tan et al., 2014). The workplace is an important setting for the delivery of evidenced-based psychological interventions, it provides us with the potential to engage a large number of people, but it is likely that the delivery of occupational health interventions is different to the delivery of health interventions in a community or health setting. The context of the workplace may affect the way that these interventions are delivered and received and may influence their effectiveness, although empirical evidence to support this assumption is lacking. With this in mind, it is imperative that we increase our understanding of what the barriers and facilitators to delivering these interventions in the workplace are, and what we can do to help increase engagement and adherence. Furthermore, the role of employers in making these interventions available to their workforce and encouraging their use has not been explored. Employers make purchasing decisions and act as the gatekeepers to occupational health interventions; it is therefore important to have a greater understanding of their priorities and concerns when considering purchasing these interventions for their workforce.

1.12 Summary and rationale

The high prevalence of work related stress, depression and anxiety has a cost to the individual and their families as well as to employers and to society. There is evidence that these common mental health problems can be successfully treated in the workplace

but take up of psychological treatments by workers is low resulting in many going untreated or inadequately treated. One way to address this low take-up of psychological treatments amongst workers may be through the use of the Internet to deliver evidence-based psychological therapies. But while the evidence for the delivery of these treatments in health and community settings is robust, evidence for the delivery of these treatments in workplace settings is less clear. It is likely that the context of the workplace will affect the way that these treatments are delivered and received, and may exacerbate the low intervention engagement and adherence reported in some studies. Employers act as the gatekeepers to occupational digital mental health, yet little is known about their priorities and concerns when making purchasing decisions. With this in mind, the aim of this thesis is to get a better understanding of the way that digital mental health interventions are delivered and received in the workplace, and to provide an overview of what more can be done to help employees engage more effectively with these interventions.

1.13 Outline of studies

To address this aim, four studies were conducted; these are presented over four chapters and an appendix. Chapter 3 is a systematic review and meta-analysis, which aims to identify the effectiveness of occupational digital mental health interventions in enhancing employee psychological wellbeing and workplace effectiveness. The review also identifies intervention features that are associated with the highest rates of engagement and adherence. Chapter 4 presents the results from a pilot randomised controlled trial (RCT) designed to explore whether access to an online facilitated discussion group increased engagement with a minimally supported occupational digital mental health intervention; Appendix 1 presents the pre-registered and published protocol for the trial. Chapter 5 presents a qualitative study that explored some of the RCT's participants' experiences of using an occupational digital mental health intervention. The chapter reports what participants believed helped and hindered engagement, and presents their ideas on what a perfect digital mental health intervention might look like. Chapter 6 asks employers about what is important to them when they are making purchasing decisions about digital mental health interventions, and what do they see as the advantages and disadvantages of delivering digital mental health

interventions in the workplace. The final chapter, Chapter 7 is a summary of the novel research and a discussion of the implications of the findings.

2 Methodology

2.1 Introduction

The empirical core of this thesis is presented over four chapters. Two of the studies employed a quantitative approach (Chapters 3 and 4), and two of the studies employed a qualitative approach (Chapters 5 and 6). Mixed research methods were chosen to answer the research questions because some research questions were best addressed by quantitative methods whereas others were best addressed by qualitative methods. Despite the advantages of mixed methods research (see below), it has been suggested that in many studies there is a lack of justification of the mixed methods design (O’Cathain, Murphy & Nicholl, 2008). This chapter addresses that concern by providing a rationale for the use of mixed methods research for the programme of studies presented in the thesis.

When researchers design a programme of research, their decisions on research methods usually reflect a paradigm or philosophical approach that is based on assumptions about the nature of reality (ontology), and about how we gain knowledge of that reality (epistemology). The method (the research technique employed in a study) is directly linked to the philosophical approach, which is informed by the researcher’s ontological and epistemological position.

This chapter describes what mixed methods research is and identifies the epistemological challenge of mixed methods research. It then describes the strengths and weaknesses of qualitative and quantitative methods. The philosophical approach of pragmatism is suggested as a means of overcoming the epistemological challenge (Bishop, 2015), and the pragmatic rationale for using mixed methods in this research is stated: the pluralism of mixed methods research would enable us to answer the research questions more comprehensively than a single approach. How and when to combine methods is discussed using the typology of Creswell and Plano Clark (2011). The design of the research programme is given, with an overview of the methods used in each study and a justification for their use. Finally, a reflexive account is given of my role as a researcher in the research.

2.2 Mixed methods research

Yardley and Bishop (2015) define mixed methods research as using a combination of qualitative and quantitative methods to research topics; this can also include mixed qualitative research where qualitative methods with different epistemological foundations are combined (e.g. de Visser & Smith, 2007). Other authors describe mixed methods as both a combination of methods *and* a philosophical position (e.g., Creswell, 2011). Johnson, Onwuegbuzie and Turner (2007) view mixed methods as the third methodology or research paradigm along with quantitative and qualitative research; they provide a summary definition derived from 19 definitions given by leading researchers in the field:

Mixed methods research is the type of research in which a researcher or team of researchers combines elements of qualitative and quantitative research approaches (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the broad purposes of breadth and depth of understanding and corroboration. (p123)

The mixed methods approach has been described by some researchers as having the potential to provide richer descriptions of a phenomenon and insights that may not have been possible via a single approach (Bryman, 2007; Howe, 1988; Yardley & Bishop, 2008), and as a pragmatic approach to choosing the appropriate methods to answer a research question (Johnson & Onwuegbuzie, 2004). For other researchers, the approach is more problematic and is seen as an attempt to merge sometimes incompatible epistemologies (Buchanan, 1992; Denzin, 2012; Guba, 1990; Lincoln, 1990; Lincoln & Guba, 1985; Smith & Heshusius, 1986). The epistemological origins of quantitative methods are commonly seen as being rooted in a realist (positivist/post-positivist) paradigm and qualitative methods are seen as being rooted in an interpretative (constructivist/relativist) paradigm (Bishop, 2015; Cresswell, 2014; Johnson & Onwuegbuzie, 2004; Yardley and Bishop, 2008, 2015). These different paradigms have different assumptions and aims: a realist ontology views reality as singular and objective; the goal of research from a realist perspective is to produce objective knowledge. An interpretative ontology views reality as something derived through our

conceptual frameworks which are individually or culturally constructed; the goal of research from an interpretative perspective is to gain insight into and possibly to explain experiences and events.

Yardley and Bishop (2015) argue that this dichotomy is less relevant in a postmodern society that has seen a move from a simplistic realist belief to a convergent epistemological middle ground that has made mixed methods research more attractive. Smith and Heshusius (1986) describe this convergence as a “disregard of assumptions and [a] preoccupation with techniques [which has] had the effect of transforming qualitative inquiry into a procedural variation of quantitative inquiry” (p8) resulting in both perspectives sharing the same realist-orientated assumptions. One of the dangers of disregarding (or being ignorant of) the different epistemological assumptions within psychology is that researchers who are used to working from the dominant realist approach may apply irrelevant and inappropriate criteria for validity, or may fail to realise the full interpretive potential when applying qualitative research methods (Yardley, 2000; Yardley & Bishop, 2008).

2.3 Ontological and epistemological foundations of qualitative and quantitative methods

The goal of mixed methods research is to draw on the strengths, and minimise the limitations, of qualitative and quantitative research (Johnson & Onwuegbuzie, 2004). A description of qualitative and quantitative research and their strengths and limitations is given below.

2.3.1 Qualitative methods

Qualitative methods are useful for exploring diverse subjective meanings and experiences and their socio-cultural context (Yardley & Bishop, 2008). Researchers working with qualitative methods tend to be interested in understanding these phenomena “rather than with the identification of cause-effect relationships” (Willig, 2013, p.8). Researchers working with qualitative research methods can adopt different epistemological perspectives such as realist, phenomenological or interpretative. A

researcher working from a realist perspective would seek to generate knowledge about something that is happening and would presume that this ‘something’ exists independently of the researcher and the research participants’ views. A researcher working from a phenomenological approach would seek to produce knowledge of the subjective experience of the research participants. Phenomenological research is concerned with the quality and the texture of the experience. A researcher working from an interpretive or social constructionist approach would focus on the way in which people talk about themselves and their experiences. They are concerned with the social construction of ‘knowledge’ (Willig, 2013).

Larkin, Watts and Clifton (2006) suggest that it is possible to be ontologically realist, but epistemologically relativist: “What is *real* is not dependent on us, but the exact meaning and nature of *reality* is” (p107). As a response to this idea of reality as an intellectual construct (Larkin et al., 2006), qualitative researchers emphasise personal and epistemological reflexivity in their work: awareness about the extent to which the researcher informs and influences the research process and contributes to the construction of meaning. Personal reflexivity involves reflecting on the ways in which a researcher’s values, core beliefs and experience shape their research. Epistemological reflexivity involves reflecting on how the research question limits what it found and how the design of the study, and the method of analysis ‘constructs’ the data and the findings (Willig, 2013). Such reflexive work is not characteristic of quantitative methods presented as (or conceptualised as) objective science.

The strengths of qualitative methods include the ability to explore complex phenomena and to describe the phenomena in rich detail as they are situated in and embedded in local contexts. Qualitative methods are generally inductive (i.e. exploratory) whereas quantitative methods tend to be deductive (i.e. theory testing). Limitations of the qualitative approach are that it can take more time to collect and analyse data, and that the results may be influenced by researchers’ personal biases and idiosyncrasies (Johnson & Onwuegbuzie, 2004).

The validity and reliability of qualitative research have been raised as an issue (Yardley, 2000). Yardley (2000) argued that the validity and reliability of quantitative research is less frequently raised as an issue as there are a clear set of well established and widely

accepted conventions, methods and terminology for conducting and evaluating quantitative research. In contrast, the standards for conducting and evaluating research using qualitative methods are more difficult to define, and may vary between qualitative methods (especially between realist and relativist qualitative methods). Yardley suggests that the situation is aggravated by the immense diversity of qualitative methods:

The unwillingness of qualitative researchers to converge on a unitary set of methods, assumptions and objectives can lead to confusion and scepticism about the validity of their work. But a pluralistic ethos is central to the non-realist philosophical traditions underpinning most qualitative research. (Yardley, 2000, p.217)

2.3.2 Quantitative methods

Quantitative research methods are useful for testing hypotheses and for making predictions. The use of probability sampling and adequate sample sizes ensures that the findings of quantitative research can be more easily generalised than qualitative research. Other strengths include the use of precise, reliable and replicable measures, adequate sample sizes and controlled experimental conditions; these all reduce variability and result in high internal validity (Yardley & Bishop, 2008). Further strengths are that data collection and analysis may be quicker than qualitative methods and the results are typically considered to be relatively independent of the researcher. One weakness of this approach is that the researcher may miss out on phenomena occurring because the focus is on theory or hypothesis testing rather than on theory or hypothesis generation (Johnson & Onwuegbuzie, 2004). There may also be a lack of external validity: controlled experimental conditions and questionnaires can limit the extent to which findings can be extended to real world contexts (Yardley & Bishop, 2008).

Researchers working with quantitative research methods work from a realist epistemological perspective; there exists a reality and it is the business of science to discover that *true* reality (Guba, 1990).

2.4 Pragmatism as a response to epistemological debates

One way to transcend epistemological debates about the appropriateness of mixed methods research is pragmatism (Bishop, 2015; Cornish & Gillespie, 2009; Greene, 2008; Johnson et al., 2007; Tashakkori & Teddlie, 1998; Yardley & Butler, 2015). Pragmatism originated in the 19th century with the American philosophers Charles Sanders Peirce, William James, John Dewey and George Herbert Mead (Cornish and Gillespie, 2009). Creswell (2011) suggests that pragmatism emphasises “the research question, the value of experiences, and practical consequences, action, and understanding of real-world phenomena” (p276). Cornish and Gillespie (2009) citing Rorty (1999) describe the pragmatist approach as changing the epistemological question from “Does this knowledge accurately reflect the underlying reality?” to “Does this knowledge serve our purposes?” (p802). The pragmatic approach suggests that no one approach is intrinsically better than another, but that each approach is good at achieving its stated goal (Cornish and Gillespie, 2009). Johnson and Onwuegbuzie argue that pragmatism offers a philosophical and methodological middle position and it:

Offers a practical and outcome-orientated method of inquiry that is based on action and leads, iteratively, to further action and elimination of doubt; and it offers a method for selecting methodological mixes that can help researchers better answer many of their research questions. (p17)

2.5 Rationale for using a mixed methods approach in this thesis

The rationale for combining research methods in this research programme was pragmatic: the distinct but connected research questions indicated that the pluralism of mixed methods research would enable us to answer the research questions more comprehensively than a single method. Johnson and Onwuegbuzie (2004) argue that:

What is fundamental is the research question – research methods should follow research questions in a way that offers the best chance to obtain useful answers. Many research questions and combinations of questions are best and most fully answered through mixed research solutions. (pp17 – 18)

Tashakkori & Teddlie (1998) also highlighted the primacy of the research question when selecting the most appropriate method(s): i.e., the “dictatorship” of the research question.

2.6 How to mix methods

In addition to the epistemological challenge of mixed methods research, there is the technical challenge of how to combine specific qualitative and quantitative methods. One of the challenges of describing mixed methods research is the lack of consensus on typology. At least 15 typologies of mixed methods designs have been published (Creswell & Plano Clark, 2011). Creswell and Plano Clark (2011) identified four major types of mixed methods designs: triangulation, embedded, explanatory and exploratory. The authors identified a number of variants to each of these designs. These designs are briefly explored below:

2.6.1 Triangulation design

Triangulation describes the process where a researcher merges the findings from separate studies to try to achieve a greater understanding of the problem. The process takes place at the interpretation stage of a study after the component studies have been conducted and analysed separately. Analysis looks at whether the findings from the separate studies are convergent, divergent, or complementary. The investigation of divergent results can lead to greater insights into a phenomenon (O’Cathain, Murphy & Nicholl, 2010; Tashakkori & Teddlie, 1998). Triangulation is a concurrent design as typically the qualitative and quantitative components take place simultaneously. Both components tend to be given equal weight.

2.6.2 Embedded design

The embedded design is also a concurrent design (both components taking place simultaneously), but unlike the triangulation design, it tends to give a greater weighting to either the qualitative or quantitative component of the study. Creswell and Plano

Clark (2011) describe this design as, “one data set provides a supportive, secondary role in a study based primarily on the other data type” (p 67).

2.6.3 Explanatory design

The explanatory design is a two-phased or sequential mixed methods design. The first component study is completed before the second one begins. The emphasis in this design is on the quantitative component of the study with the qualitative data helping to explain or build upon the initial quantitative results.

2.6.4 Exploratory design

Like the explanatory design, the exploratory design is sequential and it uses one component study to build on the second component study. In the exploratory design the emphasis is on the qualitative component, with the qualitative study helping to inform the second quantitative study.

2.6.5 Following a thread

A similar approach to the exploratory design described by Creswell and Plano Clark (2011) is an approach called “following a thread” (Moran-Ellis et al., 2006; O’Cathain et al., 2010; Yardley & Bishop, 2015). This is where each composite study is conducted, analysed and presented individually with the initial results of the early studies being used to identify themes for further analysis in the later studies.

Researchers identify a question or a theme from one study and follow it across other studies - this is called the thread.

2.7 Design of the research programme

All four studies in this research programme reflect a realist/positivist ontology, but also recognise that the context of research can shape the responses we receive (Larkin et al., 2006). Using the typology of Creswell and Plano Clark (2011), the design of this research programme was explanatory with each component study being conducted and

analysed sequentially with the later qualitative studies (studies three and four) building on the initial quantitative studies (studies one and two). However, in this programme of research equal weighting was given to both methods. As described by the “following a thread” approach, themes are identified in the early studies and followed up in later studies.

Details of the methods employed for each study are provided in the relevant sections of those papers. An overview of those methods and a justification for choosing them is given below.

2.7.1 Study one: A systematic review and meta-analysis

The aim of study one (presented in Chapter 3) was to evaluate the overall effectiveness of occupational digital mental health interventions for employee psychological wellbeing and work effectiveness. The study addressed the following three questions:

- 1 Are occupational digital mental health interventions associated with lower levels of stress and mental health symptoms post intervention than control groups?
- 2 Are occupational digital mental health interventions associated with increased work effectiveness post intervention?
- 3 Which intervention features are associated with the highest levels of engagement and adherence?

The research questions invite an assessment of the current research literature on the effects of occupational digital mental health interventions. A typology of reviews (Grant & Booth, 2009) identified 14 different review types including a rapid review (described as a time-limited systematic review), a scoping review (a preliminary assessment of the potential size and scope of the literature), a narrative or literature review (an examination of recent literature), a systematic review (a systematic search, appraisal and synthesis of research evidence), and a meta-analysis (a method to combine effect sizes from quantitative studies). For the purpose of this study it was decided to conduct a systematic review and a meta-analysis. The advantage of the systematic review is that it enables us to provide a comprehensive description of the literature through a replicable

process that aims to minimise bias in the selection, appraisal and synthesis of the research; and the advantage of the meta-analysis is that it combines individual studies into one more easily understood quantitative summary of the pooled results.

A perceived weakness of the systematic review is that the hierarchy of evidence which is currently being promoted by the international Cochrane Collaboration places RCTs above studies that use other research methods (Sharland, 2012), resulting in many systematic reviews restricting study inclusion to RCTs (Grant & Booth, 2009); this may provide a less comprehensive overview of the literature than a more inclusive approach such as a narrative or literature review. One weakness of meta-analysis is that they require all included studies to be sufficiently homogeneous (avoiding what is described as comparing apples with oranges): this includes the populations that are being studied, the interventions that are delivered, the outcome measures that are being used, the control condition used, and the timeframe or intervals that are being employed. Another weakness of meta-analysis is described by Rosenthal (1979) as the “file drawer problem”; this is where studies with non-significant results do not get published, which can lead to an over-estimation of the pooled effect size. However, for the purposes of this study, a systematic review and meta-analysis enables us to comprehensively appraise and synthesise the research evidence and combine the effect sizes to provide an answer to our research questions. To address some of the problems of meta-analysis a transparent inclusion criteria was used and efforts were made to identify unpublished data.

2.7.2 Study two: A pilot randomised controlled trial

The aim of study two (presented in Chapter 4) was to identify whether exposure to a digital occupational health intervention increased if the intervention was accessed alongside a facilitated online discussion group. The specific hypothesis was that increased guidance offered through access to an online facilitated discussion group would result in an increase in the number of times that a participant logged onto the program. The aim was to measure the impact of an online discussion group, so it was important to use an appropriate quantitative method that allowed for relevant variables to be identified and appropriately manipulated or managed. A pilot RCT was conducted to help us address the aim of the study. RCTs are considered as the gold standard for

assessing the effectiveness of healthcare interventions; they are effective for determining which of a limited number of approaches are most effective at producing a pre-determined outcome (Cornish & Gillespie, 2009). However, if they are not appropriately designed, conducted, and reported they can yield biased results (Schulz, Altman, Moher, 2009). Selective outcome reporting has long been regarded as a major problem (Zhang, Liang & Li, 2017), with one study finding that 62% of trials reported at least one primary outcome that was changed, introduced or omitted (Chan, Hróbjartsson, Haahr, Gøtzsche, & Altman, 2004). The CONSORT (Consolidated Standards of Reporting Trials) statement was developed as a way to encourage adequate reporting of trial designs. The latest CONSORT statement (Eysenbach and CONSORT eHealth group, 2011) checklist includes the reporting of trial registration (item 23) and the reporting of details on where the full trial protocol can be accessed (item 24). The need to register trials in a publically available, free to access registry prior to participant enrolment is now a precondition of many journals (De Angelis et al., 2004; Summerskill, Collingridge, & Frankish, 2009). However, despite the increase in trial registration, discrepancies still remain between the registered and published outcomes of clinical trials (Jones, Keil, Holland, Caughey, & Platts-Mills, 2015; Zhang et al., 2017). Trials are guided by their protocols, making the protocols publicly available may improve the reliability and consistency in trial reporting (Schulz et al., 2009; Summerskill et al., 2009). The Journal of Medical Internet Research (JMIR) - the leading journal for publishing research on digital health interventions - advocates the submission of research protocols through the peer review process (Eysenbach, 2004a), one of the advantages of this additional scrutiny is the increase in the quality of research (Eysenbach, 2004b). Reflecting this best practice, the protocol for this study was registered in a free to access registry and published in a peer review journal (Appendix 1).

Study two focused on exposure to a digital mental health intervention in an occupational setting. Because of the relative paucity of research in this area, and the added complexity of recruiting individuals in the context of a work environment, the randomised trial was run as a pilot study. The NHS National Institute for Health Research (nihr.ac.uk) describe a pilot study as a miniature version of the main study which is run to test that study procedures for the main study (e.g. recruitment criteria, randomisation, treatment, and measures) all run smoothly. Exploratory trials such as a

pilot study are recommended for the evaluation of complex health interventions (interventions with several components; Campbell et al., 2000). As well as testing study procedures, pilot studies are useful for allowing an assessment of effect size (Campbell et al., 2000).

The aim of conducting the RCT as a pilot study was:

1. To assess recruitment rate, level of study attrition and the robustness of engagement measures.
2. To provide an effect size prediction.
3. To get a better understanding of the extent to which participants engaged with the modules and the bulletin board so that threshold levels of adherence could be refined.
4. To identify the challenges of conducting research and delivering an online intervention in the workplace.

2.7.3 Studies Three and Four: Thematic analysis of semi structured interviews with employees and employers

The aim of studies three (presented in Chapter 5) and four (presented in Chapter 6) was to get a better understanding of the facilitators and barriers to engaging with occupational digital mental health interventions from the perspective of employees (study three) and employers (study four).

Study three addressed the following questions from an employee's perspective:

1. What are the positives and the negatives of occupational digital mental health interventions?
2. What helped and what hindered engagement with occupational digital mental health interventions?
3. What more could be done to help participants engage with occupational digital mental health interventions?

4. What did participants think a perfect digital mental health intervention would look like?

Study four addressed the following questions from an employer's perspective:

- 1 What do employers see as the advantages and disadvantages of digital mental health interventions?
- 2 What are employers' priorities when selecting digital mental health interventions for their workforce?

The aim of these studies invites a more exploratory approach than the previous studies; the focus is on describing the individual's experience (or perception) of digital mental health interventions in the workplace. Qualitative methods were best suited for addressing the studies aims and the research questions.

Because of the focus on the individual experience in both studies three and four, individual interviews were more appropriate than group interviews, which would not have allowed sufficient attention to individual experience. One of the advantages of conducting individual interviews is that they can be logistically easier to arrange than negotiating with participants to keep diaries or arranging a series of focus groups in organisations across the country. Another advantage to this approach when exploring a sensitive subject such as workplace mental health is that individual interviews can be more confidential than a focus group (Robson, 2002; Willig, 2013).

Semi structured telephone interviews were used to gather data. Semi structured interviews are the most widely used method of data collection in qualitative research in psychology (Willig, 2013); they consist of a set number of open questions, with additional questions being introduced to facilitate further exploration of the subject. The advantage of semi structured interviews over fully structured (predetermined questions, with fixed wording presented in a fixed order) or unstructured (where the conversation develops within an area of interest) is that they provide the structure to maintain a focused interview, with the flexibility to explore the subject areas further.

For pragmatic reasons, the interviews were conducted using the telephone. There is a large body of literature that supports the use of telephone interviews in research (Cachia

& Millward, 2011; Drabble, Trocki, Salcedo, Walker & Korcha, 2016; Sturges & Hanrahan, 2004); a number of advantages to this approach have been identified compared with face-to-face (in person) approaches, these include the ability to conduct interviews across a wide geographical area, increased flexibility for scheduling, reduced costs, and increased interviewer safety (Cachia & Millward, 2011; Drabble et al., 2016; Novick, 2008). The use of telephone interviews can also make it easier to ensure confidentiality; interviewees report privacy as an advantage of telephone interviews (Sturges & Hanrahan, 2004). As well as being a convenient way to conduct interviews, telephone interviews may also have higher ecological validity as they were mostly conducted when the participant was at work (the locus of interest). It has been suggested that the lack of physical presence, contextual data, and visual cues can make it more difficult to establish rapport (Novick, 2008), but it could also be argued that the anonymity of the telephone may facilitate disclosure.

Various analytic approaches can be employed in qualitative research. The focus of both study three and study four was to get an understanding about experience and sense making; this ruled out the analytic approach of discursive psychology, which is concerned with the way that people use language to negotiate and manage social interactions; its focus is on “how particular versions of reality are manufactured, negotiated and deployed in conversation” (Willig, 2013. p125). Furthermore, discursive psychology questions whether we can get to reality through language especially in the constructed context of an interview (Willig, 2013). It is rooted in the social constructionist epistemology. The analytic approach of interpretative phenomenological analysis (IPA) is concerned with the individual’s sense making of their experience. It is, however, attached to a phenomenological epistemology and tends to be used to explore significant, transformative issues that often focus on identity and sense of self (Smith & Eatough, 2012) at a level of detail that would not be needed to address the specific questions in these studies. Grounded theory is another method of analysis that might have been suitable for these studies. Its independence from any particular epistemological and ontological base and its goal of “systematically identifying and describing features of qualitative data, which recur across many participants” (Marks & Yardley, 2004, p.67) mean that it might have been appropriate, but grounded theory is an inductive (bottom up, data driven) method, which involves the construction of theory via a protracted iterative “constant comparative” method of data collection, analysis,

and theory collection, across different purposively selected samples. The aim of these studies was not to generate the theory of occupational digital mental health interventions, but to understand the experience of people using and purchasing them.

The evaluative and refinement nature of the research questions in this study (i.e., what worked best and what could be improved etc.) were best matched by thematic analysis which is exploratory like IPA and allows multi-sample comparisons like grounded theory, but it is much more flexible and is not so bound by theory or the need to develop theory. Its independence from any particular epistemological and ontological base makes the analytic approach of thematic analysis particularly suitable for these studies, as is its goal of “systematically identifying and describing features of qualitative data, which recur across many participants” (Marks & Yardley 2004, p.67).

2.8 Reflexive account

Reflexivity describes the process of the researcher engaging in a “self-aware meta-analysis of the research process” (Finlay 2002 p531). It is a recognition that the researcher’s values, core beliefs and experiences shape the way that they conceive, conduct, analyse and present their research, and that “meanings are seen to be negotiated between researcher and researched within a particular social context so that another researcher in a different relationship will unfold a different story” (Finlay 2002 p531).

The process of reflexivity is important, especially in qualitative research as it encourages us to reflect on the way in which we can impact on the research and its findings. This not only includes acknowledging our biases, but also reflecting on how our own experiences and our reactions to the research context can lead to certain insights and understandings (Willig, 2013).

Prior to starting my PhD, I developed a digital stress management intervention, WorkGuru, and I continue to have a commercial interest in it. My interest in researching adherence to and take-up of occupational digital mental health interventions came from my experience of developing and running my own intervention. Researcher allegiance

has been shown to significantly affect the results of research (Luborsky et al., 1999), and there is a suggestion that developer led research in trials of Internet interventions can report greater effect sizes than independent evaluations (Gilbody et al., 2015). A number of measures have been taken to ensure transparency in the research. Both the systematic review and meta-analysis and the RCT were conducted and reported following rigorous guidance. The protocol for the systematic review and meta-analysis was pre-registered with the International Prospective Register of Systematic Reviews, it was conducted following the Cochrane guidance (Higgins & Green, 2011) and reported following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Moher, Liberatir, Tetzlaff & Altman for the PRISMA group 2009). The protocol for the RCT was pre-registered with ClinicalTrials.gov, and it was published in a peer review journal; it was conducted and reported in line with the CONSORT eHealth checklist (Eysenbach et al., 2011). As recommended by Rozentel et al., (2014) a question was included to identify any negative effects of the intervention. The pre-registering of the protocol, the reporting against specific criteria, and the reporting of negative effects ensured maximum transparency. While I was responsible for the collection and analysis of the data for both of these studies, the process was supervised by my co-authors who had full access to all the data.

The epistemological assumptions of quantitative research suggest that the aim of research is to obtain ‘objective’ knowledge that is free of the influence of researchers, but this aspiration is seen as being unachievable and inappropriate in qualitative research (Yardley, 2017). The criterion for demonstrating the validity and quality of quantitative research does not apply to qualitative research. Yardley (2000, 2017) has identified four key dimensions for enhancing, evaluating and demonstrating the quality of qualitative research: sensitivity to context, commitment and rigour, transparency and coherence, and impact and importance. Further information on these dimensions is given in Table 2.1.

Table 2.1: Characteristics of good (qualitative) research. (Yardley, 2000)

Sensitivity to context	<i>Theoretical; relevant literature; empirical data; sociocultural setting; participants' perspectives; ethical issues.</i>
Commitment and rigour	<i>In-depth engagement with topic; methodological competence/skill; thorough data collection; depth/breadth of analysis.</i>
Transparency and coherence	<i>Clarity and power of description/argument; transparent methods and data protection; fit between theory and method; reflexivity.</i>
Impact and importance	<i>Theoretical (enriching understanding); socio-cultural; practical (for community, policy makers, health workers).</i>

Sensitivity to context is demonstrated in both the qualitative studies in this thesis by the grounding of the research in previous relevant empirical studies. Both studies explore findings in the context of previous research rather than present them in isolation; this ensures that the programme of research has a wider relevance than my own self-interest. Context is also relevant because both studies are conducted in the context of the workplace. Meaning is derived through an awareness of that context (e.g. expectations of employees, financial pressures on organisations, and the perception of mental health in the workplace). My experience of working in organisations provided a basis from which I engaged with participants and with the data.

Commitment, rigour, transparency and coherence are demonstrated in the studies in a number of ways: commitment has been demonstrated through the prolonged engagement I have had with the subject area in my role as developer of a stress management intervention; through the process of marketing WorkGuru I have spoken with numerous employers about their perception of digital mental health interventions, and I have supported organisations to deliver these interventions in their workplace.

This knowledge provided insight and context for developing, and conducting the research and was particularly useful for recruiting organisations to the research. Rigour was demonstrated through the quality of the data that was collected and the completeness of the analysis. Both myself and the second author for each study coded a subset of verbatim transcripts, inconsistencies were resolved, and the remaining transcripts were coded by me with supervisory overview. Transparency was achieved by detailing the data collection and analysis process, and by presenting excerpts of the textual data which allowed readers to identify themes and meaning for themselves. Coherence was achieved through the fit of the research questions (predominantly evaluative and refinement), the philosophical perspective (realist/positivist), the method of investigation (semi-structured individual interviews), and the analysis undertaken (thematic analysis). Comprehensive reflections on the limitations of the research were made in both studies.

Both studies were conducted in the context of the workplace resulting in a close fit between the research and the practice it wished to influence, this enhanced both the impact and the importance of the research; this was further demonstrated by me being asked to present the research to practitioner (occupational therapy, and HR) groups.

As well as developing the intervention used in the RCT, for pragmatic reasons (this research was conducted as part of a PhD and did not have access to external funding) I also provided the online coaching delivered as part of the program. No attempt was made to conceal the fact that I had developed the intervention or that I had provided the coaching (my first name was used in all contact with the participants), but a separation was made between my role as a coach (contact was made through the WorkGuru messaging system) and my role as a researcher (contact was made through my university email); furthermore, no reference was made during the interviews to me developing the intervention, or to me acting as the coach; the role of the coach was only discussed as an abstract construct. Information that I had as a developer or as a coach was not disclosed during the interviews. For example, if a participant said something that was factually untrue about the program, or recalled an event that I recalled differently as a coach, this was not commented on. This separation between roles was helped by the semi-structured nature of the interviews (the focus of the interviews was

pre-defined) and the use of telephone interviews; using the telephone added a layer of anonymity.

Finally, during the course of the interviews with the employers, no mention was made of WorkGuru (not all of the participants were familiar with WorkGuru), digital health interventions were discussed in the abstract rather than talking about a specific intervention.

3 Systematic review and meta-analysis of digital mental health interventions delivered in the workplace

Carolan, S., Harris, R. P., & Cavanagh, K. (2017.). Improving Employee Well-Being and Effectiveness: Systematic Review and Meta-Analysis of Web-Based Psychological Interventions Delivered in the Workplace. *J Med Internet Res*, 19(7): e271.
DOI:10.2196/jmir.7583

3.1 Abstract

Background: Stress, depression, and anxiety among working populations can result in reduced work performance and increased absenteeism. Although there is evidence that these common mental health problems are preventable and treatable in the workplace, uptake of psychological treatments among the working population is low. One way to address this may be the delivery of occupational digital mental health interventions. While there is convincing evidence for delivering digital psychological interventions within a health and community context, there is no systematic review or meta-analysis of these interventions in an occupational setting.

Objective: The aim of this study was to identify the effectiveness of occupational digital mental health interventions in enhancing employee psychological well-being and increasing work effectiveness and to identify intervention features associated with the highest rates of engagement and adherence.

Methods: A systematic review of the literature was conducted using Cochrane guidelines. Papers published from January 2000 to May 2016 were searched in the PsychINFO, MEDLINE, PubMed, Science Direct, and the Cochrane databases, as well as the databases of the researchers and relevant websites. Unpublished data was sought using the Conference Proceedings Citation Index and the Clinical Trials and International Standard Randomized Controlled Trial Number (ISRCTN) research

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registers. A meta-analysis was conducted by applying a random-effects model to assess the pooled effect size for psychological well-being and the work effectiveness outcomes. A positive deviance approach was used to identify those intervention features associated with the highest rates of engagement and adherence.

Results: In total, 21 randomized controlled trials (RCTs) met the search criteria. Occupational digital mental health interventions had a statistically significant effect post intervention on both psychological well-being ($g=0.37$, 95% CI 0.23-0.50) and work effectiveness ($g=0.25$, 95% CI 0.09-0.41) compared with the control condition. No statistically significant differences were found on either outcome between studies using cognitive behavioral therapy (CBT) approaches (as defined by the authors) compared with other psychological approaches, offering guidance compared with self-guidance, or recruiting from a targeted workplace population compared with a universal workplace population. In-depth analysis of the interventions identified by the positive deviance approach suggests that interventions that offer guidance are delivered over a shorter time frame (6 to 7 weeks), utilize secondary modalities for delivering the interventions and engaging users (ie, emails and text messages [short message service, SMS]), and use elements of persuasive technology (ie, self-monitoring and tailoring), may achieve greater engagement and adherence.

Conclusions: This review provides evidence that occupational digital mental health interventions can improve workers' psychological well-being and increase work effectiveness. It identifies intervention characteristics that may increase engagement. Recommendations are made for future research, practice, and intervention development.

Keywords: adherence; engagement; Internet; meta-analysis; psychological interventions; stress; systematic review; wellbeing; workplace

3.2 Introduction

3.2.1 Background

Nearly one in three workers in Europe [1] and the United States [2] report that they are affected by stress at work. Work-related stress, depression, and anxiety can result in reduced work performance and absenteeism [3-7], costing an estimated 3% to 4% of gross national product [1]. There is evidence that these conditions are both preventable and treatable in the workplace [8-9] and that workers who receive treatment are more likely to be highly productive [10,11].

The workplace has been identified as a potentially ideal site for delivering mental health prevention programs [12] and increasing access to appropriate treatment [7], resulting in a benefit to both employees and employers [11]. However, uptake of psychological treatments among the working population is low [10], with one study reporting that only 15% of workers with a mental health problem had sought help in the preceding month [13], resulting in many depressed workers going untreated or being inadequately treated [11]. Help seeking among the working population has been reported at between 43% [10] and 15% [13]. People are increasingly turning to the Internet for health care information [14], prevention, and treatment [15]. Although there is convincing empirical evidence for the effectiveness of evidence based digital psychological interventions delivered within a health and community context, the evidence for digital interventions delivered in a workplace setting is less clear [16].

Several meta analyses and systematic reviews have found evidence for the effectiveness of digital psychological interventions delivered in nonworkplace settings for common mental health problems including depression, anxiety [17-23], and stress in adults [24], but these reviews do not focus on the delivery of these interventions to working adults or in the workplace. We suggest that the delivery of occupational health interventions is different to the delivery of interventions in health or community settings and that the context of the workplace is likely to impact on the way that these interventions are delivered and received, and is therefore, likely to impact on their effectiveness. To our

knowledge no previous systematic review has specifically reported on digital interventions for stress and mental health in the workplace.

This systematic review and meta-analysis seeks to address this gap in the literature by identifying studies that deliver digital occupational mental health interventions and evaluating their effectiveness at increasing employee psychological well-being (by targeting a reduction in stress, depression, and psychological distress) and work effectiveness.

Engagement and adherence are two of the major challenges to delivering and evaluating Web-based interventions [25-27]. Boosting engagement and adherence with Web-based interventions increases the extent to which users are exposed to the content and may be an important determinant of effectiveness [28] and a consistent predictor of positive outcomes [29-31].

This review uses a positive deviance approach (eg, [32,33]) to identify the intervention features that are associated with the highest levels of intervention engagement and adherence in the workplace context.

3.2.2 Aims of This Review

The aims of this systematic review and meta-analysis are to evaluate the overall effectiveness of digital mental health interventions for employee psychological well-being and work effectiveness and to identify, through the partial implementation of positive deviance methodology, which intervention features influence engagement and adherence. To this end, the review will address the following three questions:

1. Are occupational digital mental health interventions associated with lower levels of stress and mental health symptoms post intervention than control groups?
2. Are occupational digital mental health interventions associated with increased work effectiveness post intervention?
3. Which intervention features are associated with the highest levels of engagement and adherence?

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3.3 Methods

3.3.1 Search Strategy

This review was conducted following the Cochrane guidance for systematic reviews [34]. We searched PsychINFO, MEDLINE, PubMed, Science Direct, and the Cochrane database of systematic reviews for relevant studies published from January 2000 to May 2016. The key terms used for these searches are displayed in Table 3.1. To increase coverage, we searched the databases of the researchers, relevant websites (eg, the Health and Safety Executive, the Faculty of Occupational Medicine, and the National Institute for Health and Care Excellence), reference lists of included studies, and relevant journals. Unpublished data was sought using the Conference Proceedings Citation Index and the Clinical Trials and ISRCTN research registers. Three potentially relevant trials were identified through the research registers, and the researchers were contacted. However, no additional data from these unpublished studies became available.

Table 3.1: Search terms

(stress OR	AND (intervention OR	AND (online	AND (Workplace
		OR	OR
resilien*	“stress management”	Internet	“work place”
“mental health”	“stress inoculation training”	web-based	“occupational
depress*	resilience	app	health”
anxiety	“problem solving”	computer)	worker*
“mental illness”	self-help		employee*
burnout	CBT		business*
“psychological ill	“cognitive behav* therapy”)		staff
health”			work
“mental disorder”			“work related”
“mood disorder”)			job*)

3.3.2 *Inclusion and Exclusion Criteria*

To meet the aims of this review, a study had to meet the following criteria: (1) use a randomized controlled design; (2) utilize a nontreatment, treatment as usual, or active control; (3) aimed at employed participants aged 18 years or over; (4) comprise a psychological intervention aimed at increasing psychological well-being (eg, by reducing symptoms of stress or depression) or work effectiveness (eg, by increasing engagement or productivity); (5) be delivered via the Internet, mobile technology, or a computer program; (6) written in English; and (7) offer sufficient post intervention data (sample sizes, means, and standard deviations [SDs] for both the control and the treatment condition) in the paper or by contacting the authors to calculate the effect size for either a well-being or a work effectiveness outcome.

Studies were excluded if they exclusively targeted people on extended sick leave or were targeting populations with complex mental health problems including post-traumatic stress disorder (PTSD), schizophrenia, or comorbid substance misuse. Studies were also excluded if technology was used purely as a medium for communication (eg, Skype, videoconference, e-counseling): the active element of the intervention had to be delivered on the Web or via mobile technology. Studies were also excluded if homework was completed on the Web but the intervention was delivered in person.

3.3.3 *Data Extraction*

The data was coded at four levels: study, intervention, participants, and outcomes. Further information about coding categories is available from the study registration (the protocol for this systematic review and meta-analysis was registered with the International Prospective Register of Systematic Reviews (PROSPERO; registration number CRD42016033935).

3.3.4 Data Analysis

The number of participants and the between group, post intervention means, and SD for the control and the experimental group on selected psychological measures (measures prioritized in the order: stress, depression, and psychological distress) and selected work effectiveness measures (prioritized in the order: work engagement, productivity or job specific effectiveness, work related self-efficacy, and work related rumination) were entered into Review Manager (RevMan) version 5.3 and SPSS version 22 (IBM Corp). Where more than one measure was available, the measures were prioritized in the order given above. Forest plots of the between group, post intervention effect size (Hedges g) for both outcome variables (psychological well-being and work effectiveness) were produced using RevMan. The magnitude of effect size was interpreted using the classification given by Cohen (small=0.2, medium=0.5, and large=0.8) [35].

To test for the presence of heterogeneity of effect size, we used the chi-square (χ^2) and the heterogeneity (I^2) statistics. A large χ^2 relative to its degree of freedom and a low P value provides evidence of heterogeneity [34]. An I^2 value of 25% suggests that heterogeneity is low, 50% suggests medium, and 75% suggests high [36]. Since we expected considerable heterogeneity, a random effects model was performed [37]. Heterogeneity was explored using subgroup analyses. Possible moderating factors included (1) therapeutic approach (cognitive behavioral therapy [CBT] vs other), (2) guidance (guided vs nonguided), and (3) population (targeted vs universal). Interventions were coded as using CBT if the authors of the studies described the therapeutic approach as cognitive or cognitive behavior and as guided if guidance from a person was described. We coded the population as targeted if the inclusion criteria included elevated levels of stress, depression, or insomnia. Publication bias was tested using funnel plots for both outcome measures.

3.3.5 Risk of Bias Assessment

An assessment of the methodological quality of the studies included in this review was conducted using the Cochrane Collaboration's risk of bias tool [34]. The tool assesses possible sources of bias using seven main categories: (1) random sequence generation,

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(2) allocation concealment, (3) blinding of participants and personnel, (4) blinding of outcome assessment, (5) incomplete outcome data, (6) selective reporting, and (7) other bias. Twenty-five percent of studies were assessed by the first and second author independently, with a high rate of agreement; differences were discussed and resolved. The first author completed all subsequent bias assessments. Publication bias was assessed by appraising funnel plots for asymmetry.

3.3.6 Positive Deviance

A partial implementation of the positive deviance approach was used to identify intervention features associated with the highest levels of engagement and adherence. Positive deviance is an assets-based approach used to identify sustainable solutions to difficult problems by identifying “uncommon, beneficial practices” [33]. Bradley et al [32] describe four steps to using the positive deviance approach: (1) identify “positive deviants,” that is, organizations that consistently demonstrate exceptionally high performance in the area of interest, (2) study the organizations in depth to generate hypotheses about practices that enable organizations to achieve high performance, (3) test hypotheses with other organizations, and (4) work with other organizations to disseminate the evidence about high performance. In this study, the first two steps were adapted and applied to study interventions showing the highest levels of engagement (cf. [38]). To assess engagement, we ranked the 21 studies in this review in percentile order in terms of intervention completion and intervention group study attrition. Completion of the intervention and intervention group study attrition were seen as the most relevant and widely report measures of intervention engagement and adherence. Studies at the 70th percentile and above were selected and their interventions were reviewed in depth to generate hypotheses about intervention features that may enable high levels of engagement (hypotheses generation). This is a modification from our protocol.

3.4 Results

3.4.1 Search Results

The initial search resulted in 1129 citations after duplicates had been removed. These citations were screened using the exclusion and inclusion criteria and 1076 excluded. Full papers were retrieved and examined for eligibility for the remaining 53 studies. We included 21 studies in the review: 21 in the qualitative synthesis, 21 in the psychological well-being meta-analysis, and 13 of the 21 in the work effectiveness meta-analysis. See Figure 3.1 for the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart of study selection. One study [39] did not exclude unemployed participants, but the aim of the study was to assess effectiveness of cognitive behavioral treatment for work related stress; 80% of the participants were in full time work and a number were unemployed because of work-related stress or were experiencing stress in unpaid jobs. For these reasons we included the study in the review. A sensitivity analysis indicated no difference in our overall results if this study was excluded. A second study [40] examined the effects on job stress of Web-based career identity training on Japanese hospital nurses. This study was excluded from the review as it was felt that the intervention was closer to a career counseling intervention than a psychological intervention.

3.4.2 Designs of the Included Studies

The 21 RCTs included in this review compared a Web-based psychological intervention delivered in the workplace with a wait list control (WLC) (71%, 15/21), an active control (19%, 4/21), or care as usual (9%, 2/21). Additionally, 17 (81%, 17/21) of the studies completed an intention-to-treat analysis, and 4 (19%, 4/21) studies completed a per-protocol analysis. Appendix 1 describes the selected characteristics for the 21 identified studies.

3.4.3 *Risk of Bias*

Figure 3.2 shows an estimation of the risk of bias across all studies. Of the 21 studies included in this review, only 8 (38%) were able to fulfill 5 or more low risk of bias ratings across the seven categories used. Only 2 of the studies (9%, 2/21) were able to blind both participants and personnel to the condition allocation (performance bias), and only 6 (29%, 6/21) demonstrated low reporting bias by preregistering or making their study protocol available and by reporting all the primary outcomes. Less than half of all ratings (45.6%, 67/147) were unclear or high risk.

3.4.4 *Publication Bias*

Funnel plots for the effect sizes for the psychological wellbeing outcome and the work effectiveness outcome are shown in Figures 3.3 and 3.4, respectively. There is no indication of problematic clustering in these plots, which are fairly evenly distributed around the mean effect size, suggesting little evidence of publication bias.

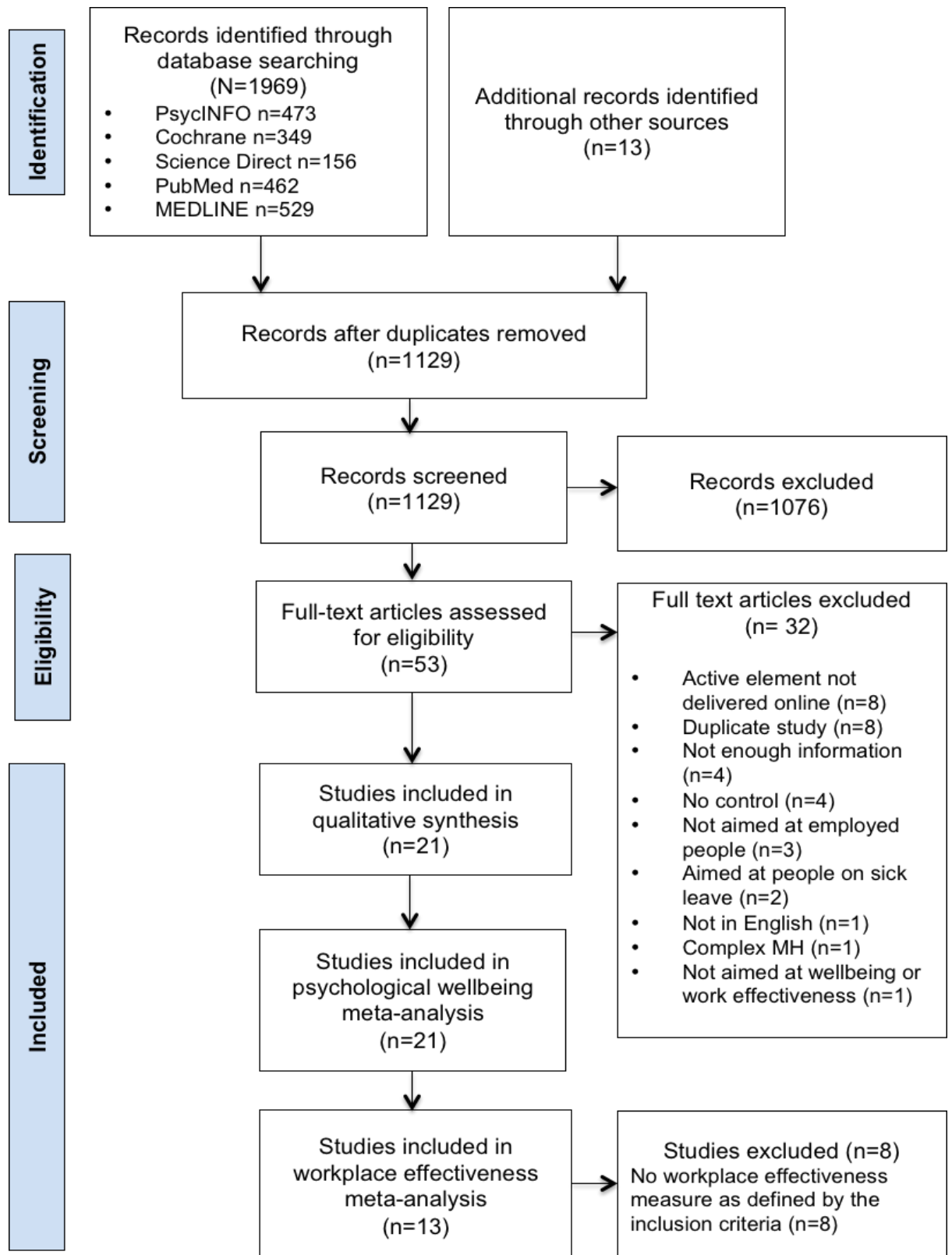


Figure 3.1: Flow diagram of study selection

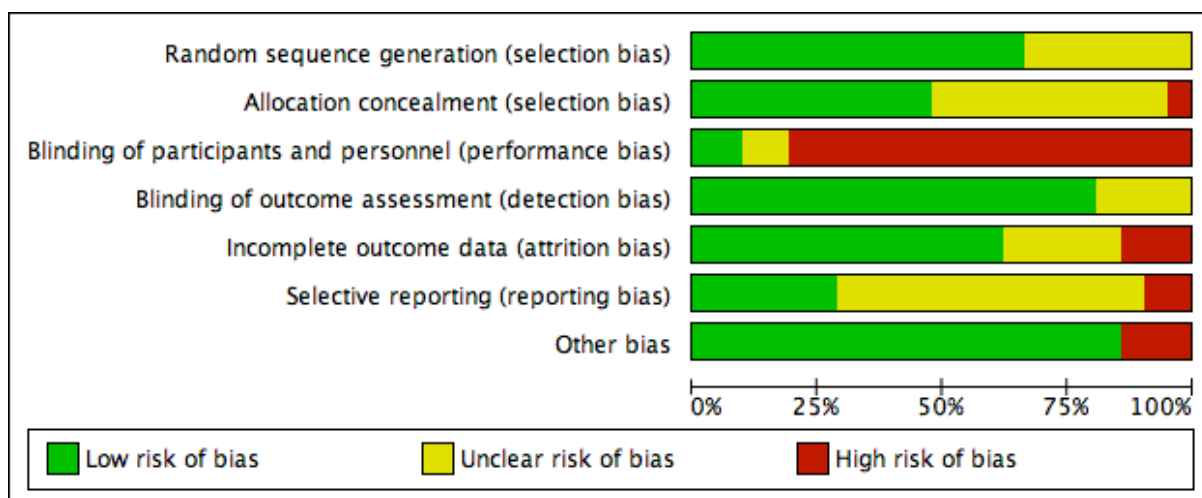


Figure 3.2: Estimated risk of bias across all studies

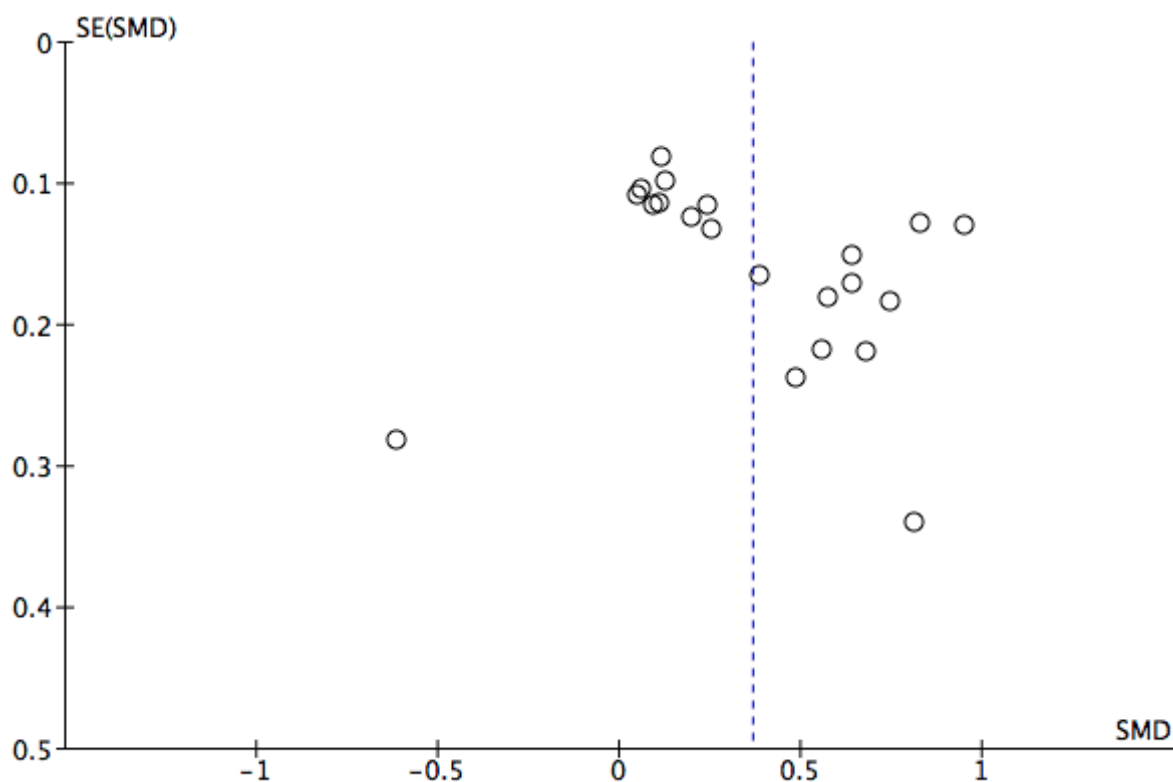


Figure 3.3: Funnel plot of post intervention effect sizes by standard error for the psychological wellbeing outcome

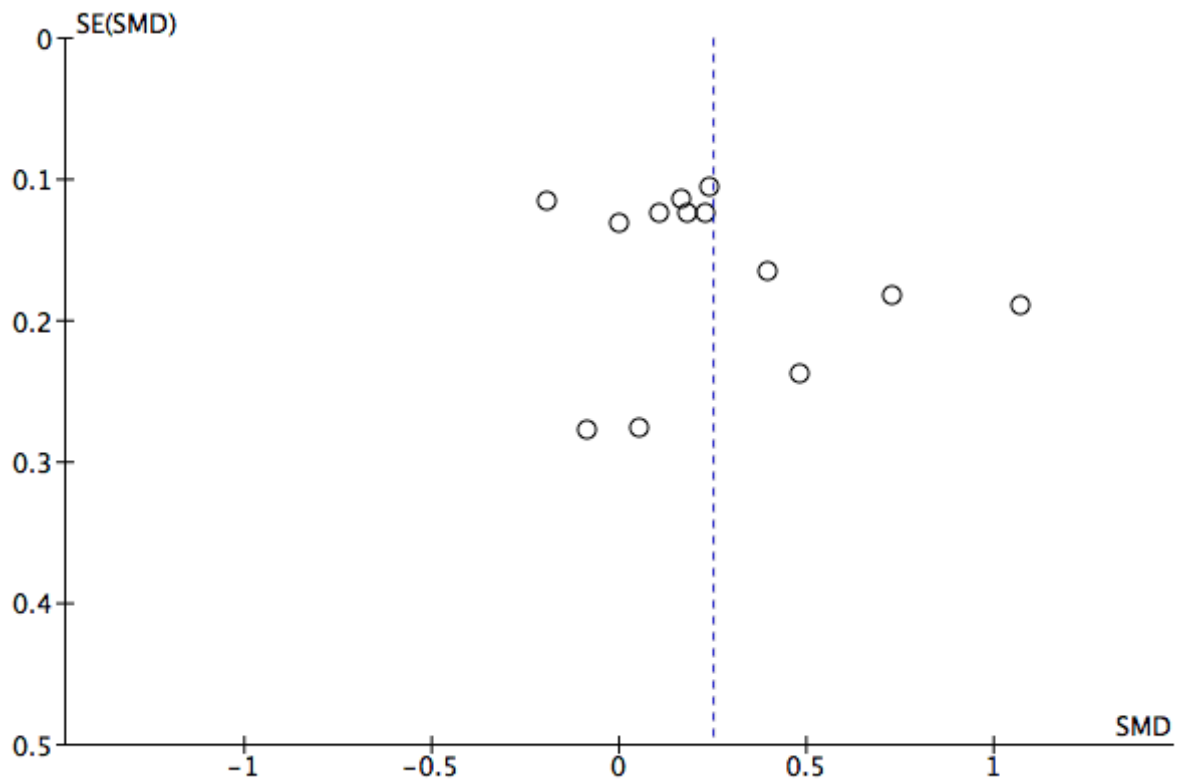


Figure 3.4: Funnel plot of post intervention effect sizes by standard error for the work effectiveness outcome

3.4.5 Sample and Study Characteristics

The 21 studies included in this review originated from 7 countries: 6 from the United States [41-46], 6 from Germany [47-52], 3 from the Netherlands [39,53,54], two each from the United Kingdom [55,56] and Japan [57,58], and one each from Australia [59] and Sweden [60]. Four of the studies recruited from the general working population [39,41,47,48], whereas the other studies recruited from organizations working in education [49-51], health, or local authorities [53,55,56]; a call center [42]; manufacturing [57]; technology [43,58]; sales [59]; chemicals [44]; human resource (HR) [45]; insurance [52]; and transport and communication [56]. One study recruited from organizations working in banking, research, education, and security [54]; 1 study recruited middle managers from medium and large companies [60], and another recruited employed care-givers of people with dementia [46].

The sample size in the studies ranged from 48 to 762. Overall, the studies recruited and randomized 5260 participants: 2711 to a psychological intervention delivered predominantly on the Web and 2549 to a control condition. The data for 2438 participants was analyzed in the experimental group and 2360 in the control group. The discrepancy in numbers between randomized and analyzed is accounted for by study attrition [55,56,58].

Women made up 58% (3051/5260) of all randomized participants. All the studies were aimed at a working age population. The range of mean ages reported across the studies was 36.4 to 48.4 years in the intervention groups and 34.3 to 47.8 years in the control groups. Nine of the studies (43%) recruited from a targeted population, including individuals with elevated levels of depression [41,54,56], stress [47-49], and insomnia [50,51]; one study recruited participants who had taken 10 or more consecutive days off work for stress, anxiety, or depression [55]. The remaining 12 studies (57%, 12/21) targeted a universal population with no set psychological inclusion criteria.

3.4.6 Intervention Characteristics

Appendix 2 describes the selected characteristics of the interventions used in the studies included in this review. Over half of the interventions were based on cognitive or cognitive behaviour therapy (12/21, 57%) [39,41,43,50,51, 53-59], with 3 based on stress and coping (14%) [46-48], 2 on mindfulness (10%) [42,44], and one each (5%) on social cognitive theory [45], problem solving training [49], positive psychology [52], and acceptance and commitment therapy [60]. The mean duration of the interventions was 7.6 weeks (SD=2.5; range 4.3 to 13.0). Seventeen (81%) of the interventions included in the studies used a website as their primary means of delivering the intervention [42-54,56-59], 2 (10%) delivered the intervention via a computer application [41,60], 1 (5%) via email [39], and one (5%) through a standalone computer [55]. Secondary modalities used by the studies to deliver the intervention and to engage users were email (12/21, 57%) [41,42,44,46,48,51-54,57-59], texting (4/21, 19%) [44,47,48,60], conference calls (2/21, 10%) [44,59], telephone calls (1/21, 5%) [59], face-to-face delivery (1/21, 5%) [44], a workbook (1/21, 5%) [44], and a compact disc (CD; 1/21, 5%) [42]. Just over half of the interventions (11/21, 52%) were self-guided

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[41-43,45-47,50,52,53,55,56], and 10 (48%, 10/21) offered users of the intervention some form of guidance: seven of those 10 studies (70%) described the guidance as coming from a therapist or coach [39,44,48,49,51,54,60], 2 (20%) were described as a coordinator or member of staff [57,59], and one (10%) as a clinical psychologist [58].

3.4.7 Study Attrition and Intervention Completion

Study attrition for the control and the intervention groups separately was available for 20 of the studies (one study reported combined study attrition [46]). The mean attrition for the intervention groups was 23% (SD=16.1, range 3% to 54%) and for the control groups 13% (SD=11.6, range 0% to 41%).

Intervention completion (adherence) data was available for 19 of the studies (data not available for 2 of the studies [41,52]). Most studies reported the percentage of participants that completed all or part of the intervention. The mean adherence (taken as the highest level of completion reported by the authors) was 45% (SD=29.3, range 3% to 95%).

3.4.8 Persuasive Technology

Studies were coded to see what if any elements of persuasive technology the interventions used to help support users to benefit from the intervention. They were coded using the classifications given by Fogg [61]. These are (1) reduction (reducing complex behavior to simple tasks), (2) tunneling (leading users through a predetermined sequence of actions or events), (3) tailoring (providing information relevant to specific individuals), (4) suggestion (making a suggestion at the most appropriate time), (5) self-monitoring (enabling people to monitor themselves), (6) surveillance (the use of computer technology to allow one party to monitor the behavior of another), and (7) conditioning (using technology to reinforce target behaviors). Seventeen of the 21 studies (81%) reported using a form of persuasive technology [39,41,43,44,46-51,53-55,57-60]. Tailoring was used by 57% (12/21) of interventions [39,43,44,46-51,53,54,58], self-monitoring by 43% (9/21) [41,44,47,50,51,55,57,59,60], and

tunneling by 14% (3/21) [41,54,55]. We were unable to identify any forms of persuasive technology in the descriptions of 19% (4/21) of studies [42,45,52,56].

3.4.9 *Meta-Analyses Findings*

Post intervention means, SDs, and group numbers were extracted from the 21 studies included in this review. Two separate meta-analyses were completed for (1) psychological well-being, and (2) work effectiveness. Of the 21 studies included in the psychological well-being meta-analysis, 13 were also included in the work effectiveness meta-analysis. Both analyses were conducted using a random-effects model.

Figure 3.5 is a forest plot for the 21 studies that included a measure of psychological well-being. The Web-based psychological intervention delivered in the workplace resulted in significantly reduced levels of stress, depression, and psychological distress scores post intervention for the intervention condition compared with the control condition ($Z_{20}=5.24$, $P<.001$) with a small effect size ($g=0.37$, 95% CI 0.23-0.50). The resulting effect sizes were significantly and highly heterogeneous ($\chi^2_{20}=103.1$ $P<.001$; $I^2=81\%$).

Figure 3.6 shows a forest plot for the 13 studies that included a work effectiveness measure. Participants in the intervention group showed significantly greater workplace effectiveness scores compared with those in the control conditions ($Z_{12}=3.00$, $P=.003$) with a small effect size ($g=0.25$, 95% CI 0.09-0.41). The resulting effect sizes were significantly and highly heterogeneous ($\chi^2_{12}=48.2$, $P<.001$, $I^2=75\%$).

The results of both meta-analyses suggested that further subgroup analyses were warranted.

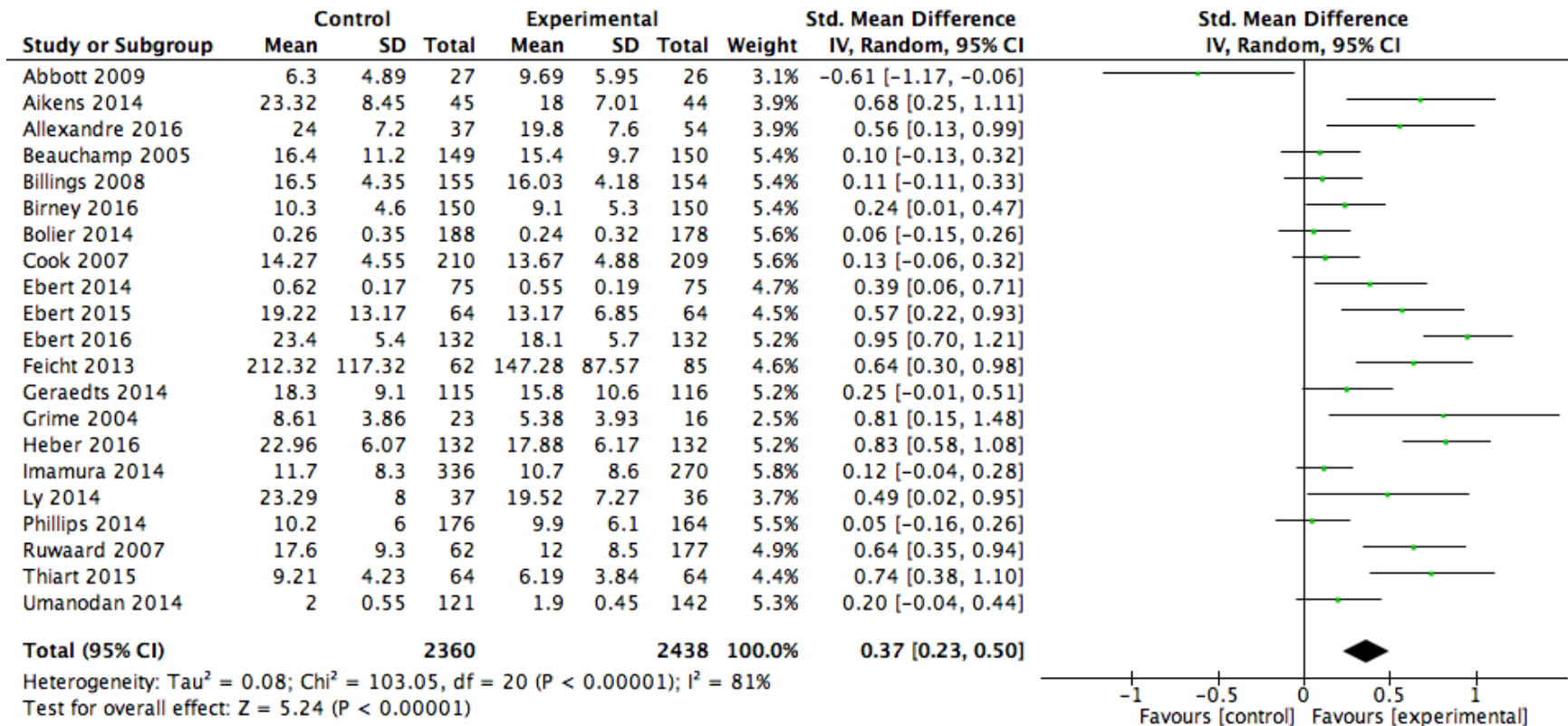


Figure 3.5: Forest plot of post intervention effect size for the psychological wellbeing outcome

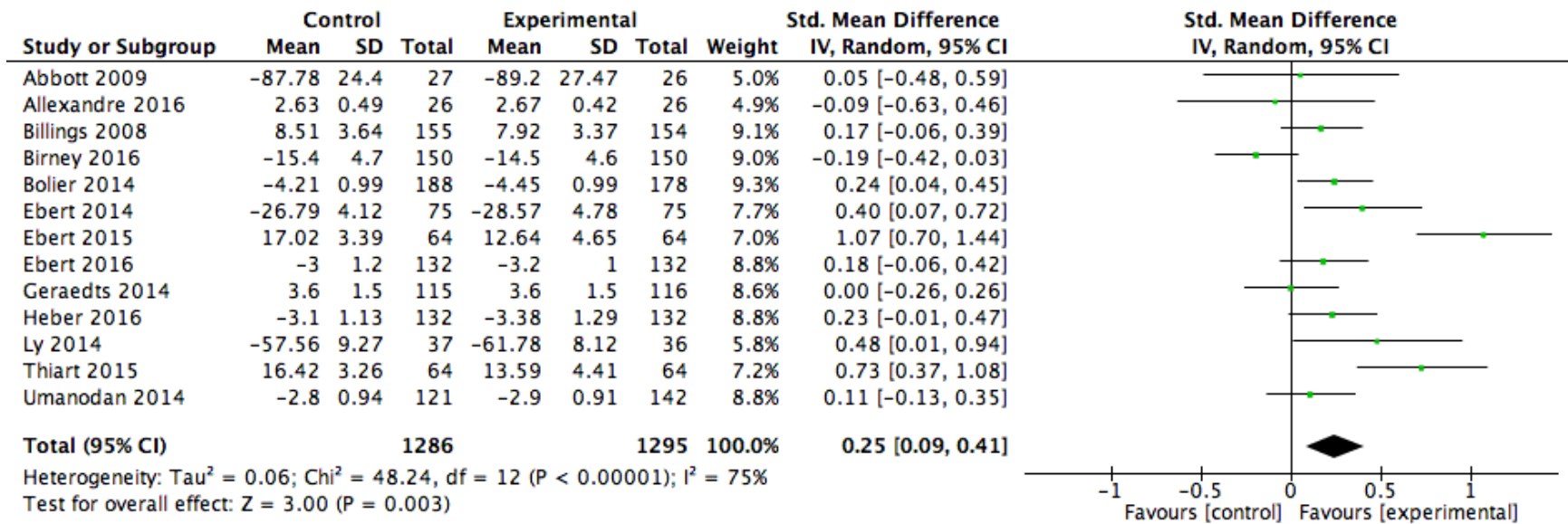


Figure 3.6: Forest plot of post intervention effect size for the work effectiveness outcome.

3.4.10 Sensitivity Analysis

We conducted outlier analysis by examining the forest plots of standard mean difference effect sizes and CIs for both the psychological well-being measure and the work effectiveness measure. One study was identified as a possible outlier on the psychological well-being outcome [59] because of its negative effect size (contrary to the other studies) and because its CIs did not fall into the range of the other studies. A sensitivity analysis excluding the study from analysis shows that the result of the main effect remains robust. A sensitivity analysis was also conducted comparing studies with lower and higher risk of bias. Studies with a low risk of bias produced larger effect sizes on the psychological well-being outcome ($d=0.57$, 95% CI 0.35-0.78) than studies with a high risk of bias ($d=0.23$, 95% CI 0.10-0.36). The groups were significantly different from each other ($\chi^2_1=6.9$, $P=.009$). No significant difference was found between the two groups on the work effectiveness outcome.

3.4.11 Subgroup Analyses

Subgroup analyses for both the psychological well-being and work effectiveness outcomes were conducted looking at (1) therapeutic approach (CBT vs other), (2) guidance (guided vs nonguided), and (3) population (targeted vs universal). Table 3.2 shows the results of the subgroup analyses.

Therapeutic Approach

Subgroup analysis of the psychological well-being outcome comparing studies using CBT ($k=12$; as described by the authors) with studies using other psychological approaches ($k=9$) showed that the groups were not significantly different from each other ($\chi^2_1=3.63$, $P=.06$), suggesting that for the psychological well-being outcome, the psychological approach used was not a source of heterogeneity. The pooled effect size for studies using the psychological approach of CBT was small ($g=0.25$, 95% CI 0.10-0.40), and for studies using other psychological approaches it was medium ($g=0.52$, 95% CI 0.28-0.76). Both are significant effect sizes ($Z_{11}=3.35$, $P \leq .001$; and $Z_8=4.28$, $P \leq .001$, respectively).

Subgroup analysis of the work effectiveness outcome comparing studies using predominantly CBT (k=8) with studies using other psychological approaches (k=5) showed that the groups were not significantly different from each other ($\chi^2_1=0.01$, $P=.94$), suggesting that for the work effectiveness outcome, the therapeutic approach was not a source of heterogeneity. The small pooled effect size for studies using CBT ($g=0.26$, 95% CI 0.01-0.50) and other psychological approaches ($g=0.25$, 95% CI 0.11-0.39) are significant ($Z_7=2.05$, $P=.04$; and $Z_4=3.47$, $P\leq.001$, respectively).

Guidance

Subgroup analysis of the psychological well-being outcome comparing interventions providing guidance (k=10) with interventions that were self-guided (k=11) showed that the groups were not significantly different from each other ($\chi^2_1=0.11$, $P=.74$), suggesting that for the psychological well-being outcome, guidance was not a source of heterogeneity. The pooled effect size for both groups was small (guided interventions: $g=0.39$, 95% CI 0.18-0.61; and self-guided interventions: $g=0.34$, 95% CI 0.16-0.53) both were significant effect sizes ($Z_9=3.58$, $P\leq.001$; and $Z_{10}=3.63$, $P\leq.001$, respectively).

Subgroup analysis of the work effectiveness outcome comparing interventions providing guidance (k=7) with interventions that were self-guided (k=6) showed that the groups were not significantly different from each other suggesting that for the work effectiveness measure, guidance was not a source of heterogeneity ($\chi^2_1=0.1$, $P=.81$). The pooled effect size for studies using interventions that are guided was a small significant effect size ($g=0.27$, 95% CI 0.08-0.45; $Z_6=2.84$, $P=.005$). The pooled effect size for interventions that are self-guided was a small nonsignificant effect size ($g=0.23$, 95% CI -0.06 to 0.51; $Z_5=1.55$, $P=.12$).

Table 3.2: Results of subgroup analyses investigating the effect of therapeutic approach, guidance, and population on outcome

Outcome	Moderator	k (n)	Intervention effects				Heterogeneity within each subgroup			
			<i>g</i>	95% CI	<i>Z</i>	<i>P</i>	χ^2	df	<i>P</i>	<i>I</i> ²
i) Therapeutic approach										
Wellbeing	CBT	12 (3002)	0.25	0.10, 0.40	3.35	.0008	38.89	11	<.0001	72%
	Other	9 (1796)	0.52	0.28, 0.76	4.28	<.0001	46.59	8	<.00001	83%
	Test for subgroup difference						3.63	1	.06	72%
Work effectiveness	CBT	8 (1778)	0.26	0.01, 0.50	2.05	.04	44.17	7	.00001	84%
	Other	5 (803)	0.25	0.11, 0.39	3.47	.0005	3.53	4	.47	0%
	Test for subgroup difference						0.01	1	.94	0%
ii) Guidance										
Wellbeing	Guided	10 (2096)	0.39	0.18, 0.61	3.58	.0003	46.59	9	<.00001	81%
	Self-guided	11 (2702)	0.34	0.16, 0.53	3.63	.0003	53.89	10	<.001	81%

Population

Subgroup analysis of the psychological well-being outcome comparing a targeted working population (k=9) with a universal working population (k=12) showed that the groups were not significantly different from each other ($\chi^2_1 = 3.59$, $P = .06$), suggesting that for the psychological well-being outcome, population was not a source of heterogeneity. The pooled effect size for the targeted working population was medium ($g = 0.52$, 95% CI 0.28-0.75) and for the universal working population it was small ($g = 0.25$, 95% CI 0.11-0.40). Both were significant effect sizes ($Z_8 = 4.32$, $P \leq .001$ and $Z_{11} = 3.39$, $P \leq .001$, respectively).

Subgroup analysis of the work effectiveness outcome comparing a targeted working population (k=7) with a universal working population (k=6) showed that the groups were not significantly different from each other ($\chi^2_1 = 0.81$, $P = .37$), suggesting that for the work effectiveness measure, population was not a source of heterogeneity. The pooled effect size for both groups was small (targeted working population: $g = 0.32$, 95% CI 0.04-0.61, and universal working population: $g = 0.18$, 95% CI 0.06-0.30); both effect sizes were significant ($Z_6 = 2.21$, $P = .03$, and $Z_5 = 3.00$, $P = .003$, respectively).

3.4.12 Positive Deviance Analysis

Of the 21 studies included in this review, 6 studies were in the 70th percentile and above for the lowest attrition in the intervention group [41,47,48,51,57,60], and 4 studies were in the 70th percentile and above for the highest intervention completion [48,49,51,57]. Three studies appeared in both groups [48,51,57], leaving 7 unique studies [41,47-49,51,57,60] that we reviewed in depth to generate hypotheses about intervention features associated with the highest levels of engagement.

The mean percentage of intervention group attrition in the high engagement group was 8% (SD 4.4), and for the other studies it was 31% (SD 14.5). The mean of the highest intervention completion reported by the authors for the high engagement group was 68% (SD 22.0) and for the other studies it was 33% (SD 26.0).

Interventions presented in the 7 studies in the high engagement group were reviewed. The interventions for 5 out of the 7 studies offered guidance (71%), compared with only 5/14 of the remaining studies (36%). The mean number of weeks that the intervention was delivered in the high engagement group was 6.6 (SD=0.54, range 6-7 weeks), compared with a mean of 8.1 (SD=3.0, range 4.3-13.0 weeks) in the other studies. All 7 of the studies in the high engagement group described the use of persuasive technology (5/7, 71% self-monitoring, 4/7, 57% tailoring, 1/7, 14% tunneling), compared with 10/14 (71%) in the remaining studies (8/14, 57% tailoring, 5/14, 29% self-monitoring, and 2/14, 14% tunneling).

Six of the 7 studies (86%) in the high engagement group utilized a secondary modality for delivering the intervention and engaging users (4 studies used emailing and 3 studies used texting), compared with only 8 of the remaining 14 studies (57%). Only 2 of the 21 studies included in this review used a mobile phone app as their primary modality for delivering the intervention; both studies were included in the high engagement group.

3.4.13 Hypotheses Generation

These findings suggest that interventions that achieve the greatest engagement and adherence offer guidance, are delivered over a shorter time frame (6 to 7 weeks), utilize secondary modalities for delivering the intervention and engaging users (ie, email and text messages), and use persuasive technology (ie, self-monitoring and tailoring). There is also a suggestion that a mobile phone app is a promising modality for engaging users of occupational digital mental health interventions.

3.5 Discussion

This review is the first meta-analysis that brings together RCTs of occupational digital mental health interventions and allows us to draw conclusions about both psychological well-being and work effectiveness outcomes. The adaptation of the positive deviance approach was helpful in enabling us to identify and explore in depth the features of high

performing interventions in order to generate hypotheses about the intervention features that may promote engagement.

3.5.1 Study Characteristics

The 21 studies included in this review recruited and randomized 5260 participants. They were predominantly recruited from the knowledge sector (ie, communication, finance, business, information, research, and education services). The mean reported completion of interventions was 45%. These rates are similar to adherence rates reported for digital health (50%) [62] and digital CBT (median 56%) [63] interventions and are slightly less than those reported for guided digital CBT interventions (67.5%) [64]. Mean study attrition was higher for the intervention groups (23%) than for the control groups (13%). This is in line with a review of computerized CBT [63], which reported that participants in the intervention arm were twice as likely to drop out.

3.5.2 Intervention Characteristics

Over half of the studies included in this review used interventions that were predominantly based on CBT (57%). The mean duration of the interventions was 7.6 weeks, with just under half (48%) of the interventions offering some form of guidance. The mean adherence to the interventions was 45%. In a review of digital health interventions, Kelders et al [62] reported a mean duration of 10 weeks, adherence of 50%, and 76% of interventions offering some form of guidance, suggesting that occupational digital mental health interventions may differ somewhat from broader digital health interventions.

In this review, 81% of the interventions described in the studies used some form of persuasive technology: tailoring was used by 57%, self-monitoring by 43%, and tunnelling by 14%. Kelders et al [62] report that for the 48 mental health studies that were included in their review of digital health interventions, tailoring was used by 90%, self-monitoring by 12%, and tunneling by 100%. The discrepancy between the number and type of persuasive technologies identified in our review and the Kelders et al [62]

review is explained by differences in coding. For example, Kelders et al. [62] did not code computer-mediated communication as persuasive technology, whereas we did. If a coach provided personalized feedback on assignments, we coded this as tailoring, whereas Kelders et al. [62] only coded technology initiated communication (ie, when an automated message was sent). This and other differences in the coding make a comparison between the two reviews difficult.

3.5.3 *Meta-Analyses Findings*

Our results indicate that digital mental health interventions delivered in the workplace produced a small positive effect on psychological well-being ($g=0.37$, 95% CI 0.23-0.50, $k=21$), and a small positive effect on work effectiveness ($g=0.25$, 95% CI 0.09-0.41, $k=13$).

Our findings situate occupational digital mental health interventions as comparable with other (nondigital specific) occupational interventions in terms of impact on mental health and work effectiveness. The psychological well-being effect size is smaller but not significantly different from the medium effect size reported for a meta-analysis of occupational stress management interventions ($d=0.53$ 95% CI 0.36-0.69) [65] and is larger but not significantly different from the small effect sizes reported in meta-analyses of occupational resilience building programs ($d=0.21$, 95% CI 0.13-0.29) [66] and health promotion in the workplace programs (depression: $g=0.28$, 95% CI 0.12-0.44; anxiety $g=0.29$, 95% CI 0.06-0.53) [67], suggesting that on the psychological outcome, digital mental health interventions have a comparable effect with other occupational interventions. The work effectiveness effect size is comparable with the small effect size reported in a meta-analysis of work engagement interventions ($g=0.29$, 95% CI 0.12-0.46) [68], suggesting that digital mental health interventions have comparable effects with alternative approaches to enhancing engagement in the workplace.

The psychological well-being effect size for occupational digital mental health interventions in our review is also comparable with digital mental health interventions delivered in health and community settings for adults with depression [17,22] and

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similar to digital stress management interventions delivered in community, occupational, and health contexts [24]. Eight studies in the Heber et al [24] review also met the criteria for inclusion in the present review, but less than half of the 23 studies were set within an occupational context.

Our findings suggest that occupational digital mental health interventions are as effective at improving mental health outcomes as are other more traditional, nondigital occupational programs and other digital interventions delivered in nonoccupational settings. This is impressive given that the workplace context may impact on the way that digital mental health interventions are delivered and received. For example, it has been suggested that two of the advantages of digital health interventions compared with face-to-face or group interventions are increased accessibility, with participants being able to access at a time and a pace convenient for them [23,25,27,30,69], and increased anonymity [23,27,30]. It is these perceived advantages that researchers suggest make digital interventions particularly suited to the workplace [70]. But it is possible that these attributes don't manifest as advantages in occupational settings; the lack of structure around "attending" digital health interventions may impact on uptake and attendance. Face-to-face or group interventions have a predetermined time for attendance during the working day, possibly with monitoring or reporting of participation to line managers. Digital mental health interventions tend to have less formal attendance with participants expected to attend at a time convenient to them. This flexibility and lack of monitoring, especially among a stressed population who may perceive themselves as time poor, may have a negative impact on intervention engagement; participants may not prioritize the time they need to engage with the intervention during their working day and may resent the intrusion of what they could perceive as work into their evening or weekends.

Furthermore, within an occupational setting, accessing digital mental health interventions may not be anonymous or even confidential. Access to the intervention may be managed through line management or occupational health; employees that do not have job autonomy may need to get permission to access the intervention during the working day, and employees working in an open plan office or sharing computer equipment may feel exposed when accessing the intervention at work. It is also possible

that during the working day employees are so invested in appearing competent and strong that they are not willing or able to engage with a digital mental health intervention. The workplace may not be the appropriate setting to embrace the vulnerability that comes with acknowledging and addressing mental health challenges.

Further research is needed to gain a clearer understanding of the challenges and benefits of delivering digital mental health interventions within occupational settings.

Nevertheless, despite the possibility that the workplace may provide additional challenges to the way that these interventions are delivered and received, our study has shown that occupational digital mental health interventions are effective at improving psychological well-being and work effectiveness.

3.5.4 Subgroup Analyses

Therapeutic Approach

The results of our review would suggest that as it is currently being delivered; CBT-based occupational digital mental health interventions are not producing superior results compared with digital interventions using other psychological approaches. Subgroup analysis comparing studies in our review using approaches described by the study authors as cognitive or cognitive behavioral therapy with studies using other psychological approaches revealed that the groups are not significantly different from each other on either the psychological well-being or work effectiveness measures. These findings are contrary to the established literature.

A meta-analysis of digital psychological treatments for adult depression also found no difference between CBT and other approaches [17], but a meta-analysis of digital psychological interventions for a range of problems did report a larger effect size for interventions using CBT compared with other therapeutic approaches [71].

Furthermore, meta-analyses on digital CBT consistently report higher effect sizes than were found in this review [20,23].

One explanation for this may be that as they are currently being delivered, CBT-based digital mental health interventions are not optimized for delivery in occupational

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settings. In a recent review of occupational digital health, Lehr et al [16] observed that the theoretical background for many of these predominantly CBT-based interventions fails to incorporate theoretical frameworks of occupational stress. Relevant theoretical models include the effort reward imbalance model [72], the person-environment fit model (for an overview see [73]), and the job demands-control model [74].

Incorporating these frameworks into the content of occupational digital mental health interventions may make the interventions more relevant and sensitive to the workplace [16] and may increase the capacity of all psychological approaches to meet the needs of occupational groups.

Guidance

No significant difference was found in our review between interventions that provide guidance with those that are self-guided. This is different to the established literature, which has consistently found that guided Internet interventions are significantly superior to unguided interventions [17,22-24,28,75-78]. A review by Grist and Cavanagh [20] on computerized CBT for common mental health problems also found no significant difference in effect size between guided and unguided programs. The authors suggested caution in interpreting their findings as only 5 studies using unguided programs had been identified. Low power from a small number of studies may also be an issue for this study; consequently, we too suggest caution in interpreting these findings. Another explanation for these findings may be the failure of this review to adequately code and differentiate the extent and form of guidance that is offered to participants and the extent to which that guidance is utilized. A recent review of digital interventions for stress differentiated between (1) guided interventions, (2) adherence-focused guidance (feedback on request), and (3) unguided interventions that provided email or telephone reminders [24]. This review did not make such a distinction, differentiating solely between interventions that did not describe guidance in any form and interventions that did describe some form of guidance. Furthermore, some studies' failure to adequately describe the in-program-support offered to participants may have resulted in some studies being wrongly categorized as unguided or guided. It is also unclear from some of the study descriptions whether support was being offered to participants outside the digital intervention, such as from an employee assistance program (EAP) or an occupational health team.

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It is worth noting that the positive deviance analysis found 71% of studies in the high engagement group offered guidance compared with only 36% in the remaining studies, suggesting that there may be a link between the provision of guidance and increased engagement with occupational digital mental health interventions.

Targeted and Universal Populations

No significant differences were found in the review between studies that recruited a targeted population (elevated levels of depression, stress, and insomnia) and studies that targeted a universal population for either well-being or work effectiveness outcomes. However, there was a trend in both cases for studies with a targeted population to have a larger effect size, suggesting that individuals with raised levels of stress, depression, and insomnia benefit more from occupational digital mental health. One explanation for this might be that the measures used may not be sensitive to change at the lower end of the scale. Another explanation might be that participants with raised levels of psychological distress may be more motivated to implement the learning in the program and therefore produce more immediate post intervention results.

These findings are contrary to a meta-analysis on workplace resilience interventions, which found weaker effects among targeted populations compared with universal populations at post intervention [66]. That study reported that the effects of occupational resilience-building diminished sharply over time among the universal population but increased in the targeted population, suggesting that for a resilience-building program the benefits amongst a targeted population may increase with time [66].

3.5.5 Positive Deviance

Maximizing engagement with, and adherence to, digital health interventions remains a pressing concern. The partial implementation of the positive deviance approach used in this review suggests that, within an occupational setting, interventions that achieve the greatest engagement and adherence offer guidance, are delivered over a shorter time frame (6 to 7 weeks), utilize secondary modalities for delivering the intervention and

engaging users (ie, email and text messages), and use persuasive technology (ie, self-monitoring and tailoring). These findings echo the literature on digital health interventions. In reviews of the design features that promote adherence to digital health interventions, evidence has also been found for increased guidance [62], the shorter duration of the intervention [78], contact through email or phone [30], and incorporating tailoring and self-monitoring [79]. Meta-analyses of occupational stress management interventions [65], digital stress management in the general adult population [24], and digital psychological treatment for depression [22] also found evidence for the increased effectiveness of interventions delivered over a similar period. We would recommend the development and testing of optimized occupational digital mental health interventions based on these principles.

Only 2 of the 21 studies included in this review used a mobile phone app as their primary modality of intervention delivery. Both studies were included in the high engagement group, suggesting that app technology is a promising modality for engaging users of occupational digital mental health interventions.

3.5.6 Limitations

This study highlights limitations in the broader digital mental well-being literature. One limitation is the small number of studies that measured occupational outcomes. Although the studies included in the review were aimed at employed participants and delivered within workplace contexts, most of them reported the reduction of psychological symptoms and failed to report occupational outcomes. We would recommend that future trials of psychological interventions delivered in the workplace incorporate occupational outcome measures, including work effectiveness.

Another limitation was the considerable heterogeneity that was found across the studies. This included variation in the measures used (particularly in the work effectiveness measures), variations in the guidance given and the adherence, therapeutic approach and delivery of interventions, variation in the participants including country, type of organization, role and symptom severity, and variation in the quality of the study. The large number of unclear and high-risk of bias ratings limit the quality of the studies

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included in the review. The variation across the studies suggests that the results of our study should be interpreted with caution. We recommend that future research uses more robust study designs.

The coding used in the review was limited by the description given about the interventions in the published literature. Many of the descriptions were short and appeared incomplete. This is a limitation described by other researchers [30,62,80]. Naturally, incomplete descriptions, especially descriptions of the persuasive technology and guidance, limit the strength of the conclusions that can be drawn here.

Other limitations specific to this review include the use in the positive deviance analysis of intervention completion and intervention group attrition as proxy measures of intervention engagement and adherence; the number of times that a participant logs in to an intervention or the number of modules that they complete cannot necessarily be taken as a measure of the extent to which they engage psychologically with the intervention [80,81]; Likewise, the extent to which participants comply with the study protocol is not a perfect measure of psychological engagement. It is reassuring to note, however, that a review of adherence and its impact on digital therapies [82] reported that module completion was found to be the adherence measure most related to outcomes in psychological health interventions. Other limitations to the review include our use of the term “psychological well-being.” We recognize that psychological well-being is more than the absence of stress or depression and that our use of the term in this review does not capture aspects of well-being such as autonomy, personal growth, functioning, and relationships with others. Finally, this review did not analyse follow-up data, so we are unable to draw conclusions on the long-term effect of digital occupational mental health programs.

3.5.7 Implications

This review has demonstrated that delivering digital mental health interventions in the workplace can result in improved psychological well-being and work effectiveness. Our findings suggest that interventions that achieve the greatest engagement and adherence offer guidance, are delivered over a shorter time frame (6 to 7 weeks), utilize secondary

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modalities for delivering the intervention and engaging users (ie, email and text messages), and use persuasive technology (ie, self-monitoring and tailoring). Further research is needed to test these hypotheses.

We recommend that researchers and developers of occupational digital mental health interventions acknowledge the importance of the workplace setting in the content, delivery, and analysis of their interventions. We strongly recommend that therapeutic approaches incorporate relevant theoretical frameworks of occupational stress and that further research is conducted to better understand the challenges and benefits to delivering digital mental health interventions in the workplace. We also recommend that researchers incorporate in future research nonclinical measures of psychological distress and measures of occupational outcomes so that we can learn more about the psychological and occupational impact of digital mental health. A future area of research would be the long-term effect of these interventions.

3.5.8 Conclusions

This review provides evidence that occupational digital mental health interventions can improve workers' psychological well-being and increase work effectiveness and identifies intervention characteristics that may increase engagement. We recommend that researchers and intervention developers recognize that the workplace is a dynamic and complex environment that may affect the way that individuals receive and engage with digital mental health interventions.

Acknowledgments

The authors would like to thank Kim Aikens, Douglas W Billings, Amelia Birney, Royer F Cook, Dan Hasson, Elena Heber, and Rino Umanodan for providing further information on their studies.

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Abbreviations

CBT: cognitive behavioral therapy

EAP: employee assistance program

RCT: randomized controlled trial

SD: standard deviation

WLC: wait list control

3.7 Appendix One: Selected characteristics of included studies.

Study	Population (n)	Control and data analysis	Psychological inclusion criteria	Psychological outcome (subscale) ^a	Work outcome (subscale) ^a	Study attrition at post intervention
Abbott et al, 2009 [56]	Sales managers from an Australian industrial organization (53)	Wait list control (WLC) Intention to treat (ITT)	None	Depression, Anxiety, Stress Scale (DASS-21) (stress)	Volume of product sold (% of target met)	Intervention=53.8% (14/26) Control=29.6% (8/27)
Aikens et al, 2014 [57]	Employees from a US chemical company (89)	WLC ITT	None	Perceived Stress Scale (PSS-14)	N/A ^b	Intervention=18.2% (8/44) Control=6.7% (3/45)
Allexandre et al, 2016 [52]	Employees from a US corporate call center (91 ^c)	WLC ITT	None	PSS-10	Productivity	Intervention=44.4% (24/54) Control=32.4% (12/37)
Beauchamp et al, 2005 [62]	Employed care givers of people with dementia in the	WLC Per protocol	None	Centre for Epidemiologic Studies-	N/A	Study attrition=6.7% (22/329)

	United States (299)			Depression scale (CES-D)		
Billings et al, 2008 [54]	Employees from US technology company (309)	WLC Per protocol	None	Symptoms of distress scale	Work Limitations Questionnaire (WLQ; output demands)	Intervention=26.6% (41/154) Control=14.8% (23/155)
Birney et al, 2016 [43]	Employed adults in the United States (300)	Active control (links to websites on depression) ITT	Mild to moderate depression (score of 10-19 on Patient Health Questionnaire [PHQ-9])	PHQ-9	Workplace outcome suite (WOS; engagement)	Intervention=6.7% (10/150) Control=2.7% (4/150)
Bolier et al, 2014 [49]	Nurses and allied professionals in a hospital in the Netherlands (366)	WLC ITT	None	Brief symptom inventory (BSI; depression)	Utrecht Work Engagement Scale (UWES)	Intervention=54% (96/178) Control=24.9% (45/188)
Cook et al, 2007 [58]	Employees for a US human resource (HR) company (419)	Active control (given print material on same subject)	None	Perceived stress (5-item scale)	N/A	Intervention=18.2% (38/209) Control=10.9% (23/210)

Per protocol						
Ebert et al, 2014 [46]	Teachers in Germany (150)	WLC	Elevated levels of stress ≥ 16 on CES-D	Perceived Stress Questionnaire (PSQ)	Teacher self- efficacy scale	Intervention=14.7% (11/75) Control=8% (6/75)
		ITT				
Ebert et al, 2015 [47]	Teachers in Germany (128)	WLC	Insomnia symptoms ≥ 15 on Insomnia Severity Index (ISI) and low levels of psychological detachment from work ≥ 15 on Cognitive Irritation Scale (CIS) subscale of the IS	CES-D	Work related rumination (cognitive irritation sub-scale of irritation scale)	Intervention=23.4% (15/64) Control=20.3% (13/64)
		ITT				
Ebert et al, 2016 [44]	General working population in Germany recruited via a health	WLC	Elevated levels of stress ≥ 22 on PSS- 10	PSS-10	UWES	Intervention=9.8% (13/132) Control=1.5% (2/132)
		ITT				

	insurance company (264)					
Feicht et al, 2013 [59]	Employees from two departments of a German insurance company (147)	WLC Per protocol	None	Stress Warning Signals Scale (SWS)	N/A	Intervention=15.3% (13/85) Control=8.1% (5/62)
Geraedts et al, 2014 [60]	Employees from six organizations in the Netherlands: 2 banking, 2 research, 1 security, and 1 university (231)	Care as usual (CAU) ITT	Elevated levels of depressive symptoms ≥ 16 on CES-D	CES-D	World Health Organization Health and Work Performance Questionnaire (WHO HPQ-4; 1 item work performance only)	Intervention=36.2% (42/116) Control=16.5% (19/115)
Grime 2004 [50]	National Health Service (NHS) and local authority employees recruited through a UK NHS occupational health	CAU ITT	10 or more consecutive days off work for stress, anxiety or depression in last 6 months. ≥ 4 General	Hospital Anxiety and Depression Scale (HADS; Depression)	N/A	Intervention=20% (5/24) Control=0% (0/24)

	department (48)		Health Questionnaire (GHQ-12)			
Heber et al, 2016 [45]	General working population in Germany recruited via a health insurance company (264)	WLC ITT	Elevated levels of stress ≥ 22 on PSS- 10	PSS-10	UWES	Intervention=12. 1% (16/132) Control=3.8%(5/ 132)
Imamura et al, 2014 [55]	Employees at two Japanese information technology (IT) companies (762)	Active control (email message once a month with stress management info) ITT	None	Beck depression inventory (BDI)	N/A	Intervention=29. 1% (111/381) Control=11.8% (45/381)
Ly et al, 2014 [61]	Middle managers at medium or large employers in Sweden (73)	WLC ITT	None	PSS-14	Multifactor Leadership Questionnaire (MLQ;	Intervention=8.3 % (3/36) Control=(2/37) 5.4%

					transformative leadership subscales, self-report only)	
Phillips et al, 2014 [51]	Employees recruited through the occupational health sections of 3 large UK employers: transport, health, and communication (637)	Active control (sign posting to websites with general info about mental health) ITT	≥ 2 on 5 of the 9 items on PHQ-9 and employee identified that at least one item impacted on work or home life.	PHQ-9	N/A	Intervention=46.2% (147/318) Control=41.1% (131/319)
Ruwaard et al, 2007 [41]	General population in the Netherlands ^d (239)	WLC ITT	None	DASS-42 (stress)	N/A	Intervention=15.2% (27/177) Control=1.6% (1/62)
Thiart et al, 2015 [48]	Teachers in Germany (128)	WLC ITT	Clinical insomnia (≥ 15 on the ISI), experiencing work related rumination (≥ 15 on the CIS	Penn State Worry Questionnaire (PSWQ)	Work related rumination (cognitive irritation subscale of irritation scale)	Intervention=3.1% (2/64) Control=12.5% (8/64)

subscale of the
irritation scale)

Umanodan et al, 2014 [53]	Employees from a manufacturing company in Japan (263)	WLC ITT	None	Brief Job Stress Questionnaire (BJSQ)	Japanese version of the Utrecht Work Engagement Scale (UWES-J)	Intervention=2.8 % (4/142) Control=0.8% (1/121)
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3.8 Appendix Two: Selected characteristics of included interventions.

Study	Intervention description	Type ^a	Primary modality (secondary modalities)	Persuasive tech	Guidance	Length	Adherence
Abbott et al, 2009 [56]	<i>ResilienceOnline</i> Enhancing 7 core skills of resilience. Delivered via video and slides.	Cognitive therapy	Website (telephone, conference call, and emails)	<i>Self-monitoring</i> using a questionnaire to measure resilience	Yes— member of staff (offer of telephone and conference call)	10 weeks	27% (7/26) completed the whole program
Aikens et al, 2014 [57]	<i>Mindfulness Goes to Work</i> Mindfulness delivered via virtual and in-person classes and Web-based training	Mindfulness	Website (email, texting, workbook, webinar, in person mtgs)	<i>Self-monitoring</i> using a weekly progress tracking survey. <i>Tailoring</i> using preprogramed emails as a	Yes— MBSR instructor	7 weeks	63.6% (28/44) completed ≥75% of the program

				response to the survey. Opt in text messages that correspond to progress.			
Allexandre et al, 2016 [52]	<i>Stress Free Now</i> Web-based, interactive educational program based on mindfulness meditation	Mindfulness	Website (email, compact discs [CDs])	Non described	No	8 weeks	7.4% (4/54) accessed website ≥ 4 out of 8 weeks
Beauchamp et al, 2005 [62]	<i>Care Giver's Friend: Dealing with Dementia</i> Multimedia intervention with text material and videos that model positive caregiving strategies	Stress and coping model	Website (email)	<i>Tailoring</i> via a questionnaire that produces links tailored to the individual	No	4.3 weeks	10.6% (16/150) visited ≥ 4 times (19% (29/150) visited ≥ 2)
Billings et al, 2008 [54]	<i>Stress and Mood Management</i>	Cognitive behavioral	Website	Tailoring through an	No	13 weeks	3.2% (5/154) accessed stress

	Modular, multi media program. Audio narrated with video and graphics.	therapy (CBT)		embedded assessment instrument			management module≥4 times
Birney et al, 2016 [43]	<i>MoodHacker</i> . Sequenced content delivered through in-app messaging, articles, and videos.	CBT and positive psychology	Mobile phone app (emails)	<i>Tunneling</i> through sequenced content. <i>Self-monitoring</i> of mood and activities	No	6 weeks	On average participants logged in 16 times (standard deviation [SD] 13.3)
Bolier et al, 2014 [49]	Based on personal screening, participants offered access to a number of Web-based interventions	CBT	Website (email)	<i>Tailoring</i> through automated personalized feedback and signposting to interventions	No	13 weeks	5.1% (9/178) started≥1 module
Cook et al, 2007 [58]	<i>Health connection</i> . Multimedia, health promotion for the workplace designed to	Social cognitive theory	Website	Non described	No	13 weeks	15.4% (32/209) accessed the stress management module >2

	improve dietary practices, reduce stress, and increase physical activity						
Ebert et al, 2015 [47]	<i>GET.ON Recovery</i> 6 sessions including articles, exercises, testimonies, audio, and video	Cognitive-behavioral and metacognitive techniques for insomnia	Website	<i>Tailoring</i> through content being modified depending on response options. Self-monitoring through recovery diary	No	6 weeks	48.4% (31/64) completed all sessions
Ebert et al, 2016 [44]	<i>GET.ON Stress</i> 7 sessions (plus optional booster session and 8 optional modules) including text, exercises, testimonials, audio, and video	Transactional model of stress. Problem solving and emotional	Website (text messages)	<i>Tailoring</i> through optional modules and content being modified depending on response option.	No	7 weeks	42% (55/131) completed session 7/7

		regulation.		Self-monitoring through stress diary			
Feicht et al, 2013 [59]	Happiness training focusing on exercises to achieve a positive psychological state	Positive psycholog y	Website (emails)	Non described	No	7 weeks	N/A ^g
Geraedts et al, 2014 [60]	<i>Happy@Work</i> . 6 weekly sessions including information, examples, and assignments. Weekly assignments submitted to a coach	Cognitive therapy and problem solving	Website (emails)	<i>Tunneling</i> participants unable to start new session until they receive feedback on previous session. <i>Tailoring</i> through individualized feedback from a coach	Yes— coach (feedback on assignment s)	6 weeks	26.7% (32/116) completed 6/6 lessons

Grime 2004 [50]	<i>Beating the Blues.</i> Interactive CBT program	CBT	Standalone computer	<i>Tunneling</i> , you complete one module before starting another Self-monitoring through weekly progress reports	No	8 weeks	66.7% (16/24) completed 8/8 sessions
Heber et al, 2016 [45]	<i>GET.ON Stress</i> Seven sessions (plus optional booster session) including psycho- education, interactive exercises	Transactio nal model of stress	Website (emails, text messages)	<i>Tailoring</i> through personalized feedback	Yes— coach (feedback on sessions)	7 weeks	70.5% (93/132) completed 7/7 sessions
Imamura et al, 2014 [55]	<i>Internet CBT Program: Useful mental health solutions series for business</i> Internet CBT using Manga (Japanese comic) story delivered over 6	CBT	Website (emails)	<i>Tailoring</i> through personalized feedback	Yes— clinical psychologis t (feedback on assignment s)	6 weeks	64.8% (247/381) completed 6/6 sessions

	lessons						
Ly et al, 2014 [61]	Mobile phone stress management intervention, 6 modules, each module has a short audio lecture, plus information and exercises	Acceptance and commitment therapy (ACT)	Mobile phone app (text messages)	<i>Self-monitoring</i> through personal statistics on the app	Yes—therapist (one way text messages)	6 weeks	44.4% (16/36) adhered to intervention for 6/6 weeks
Phillips et al, 2014 [51]	<i>MoodGYM</i> Interactive Web program, 5 modules, includes exercises, assessments, audio, and a game ⁱ	CBT	Website	Non described	No (phone calls as part of research only)	5 weeks	28.2% (90/318) considered high users ($\geq 50\%$ of intervention)
Ruwaard et al, 2007 [41]	7 weekly modules delivered via email. Feedback given on homework	CBT	Email	<i>Tailoring</i> of emails sent to participants	Yes—therapist (feedback on assignment)	7 weeks	72.3% (128/177) received treatment (the extent of this is not defined)

Thiart et al, 2015 [48]	<i>GET.ON Recovery</i> 6 modules with homework. Supported by coaches via email messaging, weekly feedback on exercises	Cognitive behavioral therapy for insomnia (CBT-I)	Website (emails)	Tailoring through feedback on homework <i>Self-monitoring</i> through a recovery diary	s) Yes— coach (feedback on exercises and answering questions)	6 weeks	95.3% (61/64) completed 6/6 modules
Umanodan et al, 2014 [53]	Computer-based, self- paced stress management training incorporating behavioral, communication and cognitive techniques	Cognitive behavioral techniques	Website (emails)	<i>Self-monitoring</i> of skills	Yes— coordinator (emails sent via the coordinator)	7 weeks	89.4% (127/142) completed all content

4 Increasing engagement with an occupational digital mental health intervention: Results of a pilot RCT

Carolan, S., Harris, P. R., Greenwood, K., & Cavanagh, K. (2017). Increasing engagement with an occupational digital stress management program through the use of an online facilitated discussion group: Results of a pilot randomised controlled trial. *Internet Interventions*. 10(Supplement C): 1–11. DOI:10.1016/j.invent.2017.08.001

4.1 Abstract

Introduction: Rates of work-related stress, depression and anxiety are high, resulting in reduced work performance and absenteeism. There is evidence that digital mental health interventions delivered in the workplace are an effective way of treating these conditions, but intervention engagement and adherence remain a challenge. Providing guidance can lead to greater engagement and adherence; an online facilitated discussion group may be one way of providing that guidance in a time efficient way. This study compares engagement with a minimally guided digital mental health program (WorkGuru) delivered in the workplace with a discussion group (DG) and without a discussion group (MSG), and with a wait list control (WLC); it was conducted as a pilot phase of a definitive trial.

Methods: Eighty four individuals with elevated levels of stress from six organisations were recruited to the study and randomised to one of two active conditions (DG and MSG) or a WLC. The program WorkGuru is a CBT based, eight-week stress management intervention that is delivered with minimal guidance from a coach. Data was collected at baseline, post-intervention and at 16-week follow-up via online questionnaires. The primary outcome measure was number of logins. Secondary measures included further engagement measures, and measures of depression, anxiety, stress, comfort and enthusiasm. Quality measures including satisfaction and system usability were also collected.

Results: A greater number of logins was observed for the DG compared with the MSG; this was a medium between group effect size ($d=0.51$; 95% CI: -0.04, 1.05). Small to medium effect size differences were found at T2 in favour of the active conditions compared with the control on the DASS subscales depression, anxiety and stress, and the IWP subscales enthusiasm and comfort. This was largely maintained at T3. Satisfaction with the intervention was high with individuals in the MSG reporting greater satisfaction than individuals in the DG.

Conclusions: This study shows that access to an online facilitated discussion group increases engagement with a minimally supported occupational digital mental health intervention (as defined by the number of logins), but that this doesn't necessarily result in improved psychological outcomes or increased satisfaction when compared to access to the intervention without the group. Access to the online program was associated with lower levels of depression, anxiety and stress and an increase in comfort and enthusiasm post intervention; these changes were largely maintained at follow-up.

Trial registration

This trial was registered with ClinicalTrials.gov on March the 18th 2016 NCT02729987

Keywords

CBT, Internet, online, web-based, Randomized Controlled Trial, stress, work.

Abbreviations

CAU: Care as usual

CBT: Cognitive behavioural therapy

DG: Discussion group

MSG: Minimal support group

RCT: Randomised controlled trial

WLC: Wait list control

4.2 Introduction

In the UK prevalence rates for work-related stress, depression and anxiety are high, accounting for 11.7 million lost working days (HSE 2016) and resulting at both a clinical (Birnbaum et al., 2010; Dewa, Mcdaid, Ettner, 2007; Dewa & Hoch, 2015; Sanderson & Andrews, 2006) and a sub clinical level (Martin, Blum, Beach, & Roman, 1996) in reduced work performance and absenteeism. There is evidence that these conditions are both preventable and treatable in the workplace. A recent meta-analysis has shown that digital mental health interventions delivered in the workplace can be effective at reducing psychological distress and increasing workplace effectiveness (Carolan, Harris & Cavanagh, 2017); however, despite examples of occupational digital mental health interventions that have achieved good adherence (Ebert et al., 2016; Heber, Lehr, Ebert, Berking & Riper, 2016; Thiart, Lehr, Ebert, Berking & Riper, 2015; Umanodan, Shimazu, Minami, & Kawakami, 2014) one of the challenges of digital mental health still remains increasing adherence and engagement (Cavanagh & Millings, 2013; Eysenbach, 2005; Kohl, Crutzen, & de Vries, 2013). Whilst digital interventions are typically designed for widespread accessibility, uptake can be low and the discontinuation curve steep. A randomised controlled trial (RCT) of a digital mental health intervention delivered in the workplace reported that only 5% of participants started one or more of the modules (Bolier et al., 2014), and a trial of digital mindfulness delivered in a workplace reported that between 42% and 52% of all participants in the active conditions never logged on to the program (Allexandre et al., 2016). Carolan et al. (2017) found that the mean highest reported completion across 19 studies in their meta-analysis was 45% with a range of 3% to 95%.

Research has consistently shown that providing guidance can lead to greater adherence to web-based interventions (Andersson & Cuijpers, 2009; Brouwer et al., 2011; Baumeister, Reichler, Munzinger, & Lin, 2014; Hilvert-Bruce, Rossouw, Wong, Sunderland & Andrews, 2012; Mohr, Cuijpers & Lehman, 2011). An online facilitated discussion group may be one way of providing that guidance in a time efficient way. Previous studies (Andersson et al., 2005; Berger et al., 2011; El Alaoui et al., 2015) have incorporated discussion groups into their interventions but have failed to identify the impact of the group on the effectiveness of the intervention.

Increasing engagement with an occupational digital mental health intervention:

Results of a pilot RCT

In this study we therefore compare engagement with a minimally supported CBT based digital mental health program (WorkGuru) delivered in the workplace with and without access to a facilitated discussion group, and to a wait list control (WLC), and explore whether increased engagement suggests increased effectiveness. The trial was conducted as a pilot trial to gain greater confidence in predicting effect size, refining optimum engagement of the intervention (adherence), understanding accuracy of engagement measures, and understanding the challenges of conducting the trial in the workplace.

4.3 Methods

4.3.1 Trial design

A three-arm randomised controlled trial was conducted comparing a minimally supported online CBT based stress management intervention (WorkGuru) delivered with and without an online facilitated bulletin board, with a wait list control (WLC). Randomisation was conducted on a ratio of 1:1:1. All participants had unrestricted access to care as usual (CAU). The trial was conducted to examine the effect of an online facilitated discussion group on engagement with a minimally supported digital stress management intervention delivered to employees, and to look at the estimated potential effectiveness of the program. Assessment took place at baseline (T1), at post treatments (8 weeks, T2) and at follow-up (16 weeks, T3). Participants in the active conditions completed a credibility and expectancy questionnaire at two weeks following randomisation. All assessments were completed online.

This trial was conducted and reported in line with the CONSORT eHealth checklist (Eysenbach & CONSORT EHEALTH group, 2011). Further information about this trial is available from the trial protocol (Carolan, Harris, Greenwood & Cavanagh, 2016). The study was approved by the University of Sussex Science and Technology Cross-School Research Ethics Committee (reference number ER/SC587/1), and registered with Clinical Trials.gov NCT02729987.

4.3.2 *Participants and procedure*

UK based organisations that had subscribed to the WorkGuru mailing list were invited to participate in this study. Participating organisations circulated a statement to staff inviting them to follow a link or contact the first named author (SC) for more information. Participating organisations were encouraged to offer employees a minimum of one hour a week over the eight-week period to complete the program. Participants who were: i) aged 18 or over, ii) employed by a participating organisation, iii) willing to engage with an online CBT based stress management intervention, iv) had access to the Internet, v) had access to a tablet or computer, vi) had an elevated level of stress, as demonstrated by a score of ≥ 20 on the PSS-10 (Cohen, Kamarck & Mermelstein, 1983), were recruited to the study between March and June 2016. No exclusion criteria were set. The cut off of 20 on the PSS-10 represents one standard deviation (6.53) above the mean (13.02) in a large ($n=2,387$) US general population sample (Cohen & Williamson, 1988). Participants who met the inclusion criteria were invited to complete a baseline questionnaire that was completed online. A consent statement was included on the front page of the questionnaire; participants gave consent to take part in the study by completing the questionnaire. Participants were informed that their participation was confidential and their organisation would not be informed of which employees were participating in the study. On completion of the baseline questionnaire, participants were randomised to one of the three study arms. An allocation schedule was created using a computer generated randomisation sequence (random.org). An independent researcher allocated each group (A, B, or C) as an active condition (with or without a facilitated bulletin board) or the WLC. The study researchers were blind to the group allocation. Participants allocated to the Minimal Support Group (MSG) were able to access the intervention immediately. Participants allocated to the discussion group were also able to access the intervention immediately, but were asked to wait for up to three weeks for the start of the group. The delay in starting the facilitated group was to enable an optimum number of participants to begin the group together; participants were encouraged to access the bulletin board and take

part in an introductory exercise while they were waiting for the group to start. Participants allocated to the WLC were able to access the intervention after 16 weeks.

4.3.3 Intervention

A more detailed description of the online CBT based stress management program WorkGuru is available from Carolan et al. (2016). The program was presented on a secure platform that participants logged-on to using an email address and a self-generated password. The eight-week program was based on the psychological principles of CBT, positive psychology, mindfulness and problem solving. It consisted of seven core modules that all participants were encouraged to complete and three additional modules. The core modules included information and exercises on stress, resilience, values, cognitive restructuring, automatic thoughts, unhelpful thinking styles and time management. The additional modules contained information on mindfulness, problem solving and imagining the future self. Participants completed the modules at their own pace. They could either complete a questionnaire and receive suggestions of which modules that they might find useful, or chose the modules that they wished to complete themselves. The modules consisted of a combination of educational reading, audio, short animations and interactive exercises. Participants could also complete eight self-monitoring standardised questionnaires, including the Perceived Stress Scale (Cohen et al., 1983), the Subjective Happiness Scale (Lyubomirsky & Lepper, 1999), and the Brief Resilience Scale (Smith et al., 2008). They were also able to opt-in to a weekly motivational email (the “Monday Morning Message”) that contained a motivational quotation and advice on staying well in the workplace, and could set themselves email reminders to visit the site. To encourage engagement, an online coach contacted the participants through the site when they first logged-on, at two weeks, and at six weeks. Messages from the coach were all personalised. Participants could choose to share work with the coach and could contact the coach for information or advice. The coach responded within 24 hours.

While using the WorkGuru site, users were prompted to contact their GP, NHS 111 or the Samaritans if they were concerned about their mental health. Contact details for NHS 111 and the Samaritans were given.

Minimal support group (MSG)

Participants allocated to the MSG had access to the intervention as described above.

Online discussion group (DG)

Participants allocated to the discussion group had access to the intervention as described above; they also had access to an eight-week online guided discussion group that was delivered via a bulleting board. Each week the coach introduced one or more of the modules and encouraged discussion about the topic. Participants chose a user name, and were able to be anonymous in the group.

4.3.4 Measurements

Primary outcome measure

The primary outcome measure was engagement, which was measured using the number of logins to the site. The number of logins was chosen as the primary outcome measure because it is the most commonly reported objective exposure measure used in studies of digital health (Brouwer et al., 2011; Donkin et al., 2011).

Secondary outcome measures

Secondary measures included further measures of engagement (the number of modules completed, the number of page views, self-reported engagement measures using one-item on a 5-point Likert scale with a range of 0 to 5), and of psychological outcomes: a measure of depression, anxiety and stress (DASS-21) and a measure of wellbeing at work (IWP). DASS-21 (Lovibond & Lovibond, 1995) is a 21-item scale that was designed to measure the negative emotional states of depression, anxiety and stress. Items are answered on a 4-point Likert scale (0 = did not apply to me at all; 3 = applied to me very much or most of the time). Cronbach's α for the subscales at baseline were: depression $\alpha = .88$; anxiety $\alpha = .90$; stress $\alpha = .84$ in this study. The IWP Multi-Affect

Indicator (Warr 1990) is a measure of wellbeing at work. It is a 16-item scale that is scored on a 7-point scale. Participants are asked the approximate amount of time they have felt different emotions during the week (0% of the time = never; 100% of the time = always). The subscales for depression and anxiety are reverse scored, resulting in higher scores representing higher wellbeing. Cronbach's α for the subscales at baseline were: enthusiasm $\alpha = .87$; anxiety $\alpha = .90$; comfort $\alpha = .74$; depression $\alpha = .84$ in this study.

Other measures

Other measures taken were: client satisfaction (CSQ; Larsen, Attkinson, Hargreaves, & Nguyen, 1979), which is an eight-item questionnaire that is rated on a 4-point scale with reverse scoring on four items. The questionnaire was developed to assess general satisfaction with services, $\alpha = .95$ in this study; acceptability (adapted from Schneider et al., 2012) which is a six-item questionnaire that is rated on a five-point scale (1 = strongly disagree; 5 = strongly agree), $\alpha = .62$ in this study; treatment credibility and patient expectancy (CEQ; Devilly & Borkovec, 2000), which is a six-item questionnaire that utilises two rating scales, one from 1 – 9 and the other from 0 – 100%. Participants are asked what they thought or felt about the treatment. The measure achieved $\alpha = .92$ in this study; system usability (Brooke, 1996), which is a ten-item questionnaire, rated on a five-point scale (1 = strongly disagree; 5 = strongly agree). Five of the items are reverse scored, and the sums of the scores are multiplied by 2.5 to obtain an overall value. A score of less than 50 would be regarded as a cause for significant concern; scores above 70 are seen as acceptable, with scores in-between suggesting the need for continued improvement (Bangor, Kortum & Miller 2008). In this study $\alpha = 0.92$; negative effects of treatment, using one-item developed for this study, which asks the question: “What, if any, positive or negative effects caused by the program/being in the control group did you experience?” Possible moderators explored were: goal conflicts, using the goal conflict index developed for this study. This is a three-item questionnaire that is rated on a five-point scale (1 = strongly disagree; 5 = strongly agree), $\alpha = .59$; job autonomy, using the nine-item autonomy subscale from the Work Design Questionnaire, (Morgeson & Humphrey 2006), which is rated on a five-point scale (1 = strongly disagree; 5 = strongly agree), Cronbach's alpha for the subscales at baseline

were all $\alpha = >.83$ in this study; time perception (Etkin, Evangelidis & Aaker 2015) a 5-item questionnaire, which is rated on a five-point scale (1 = strongly disagree; 5 = strongly agree), $\alpha = .74$ in this study; levels of psychological distress at baseline as measured on DASS.

Engagement measures specific to the discussion group were taken (number of views of the bulletin board and the number of contributions) as well as the Online Support Group Questionnaire (Chang, Yeh & Krumboltz, 2001), which is a nine-item questionnaire that is rated on a ten-point scale (1 = not at all; 10 = very much). Cronbach's alphas for the subscales were $\alpha > 0.77$ in this study. Existing psychological illness, CAU, sickness absence for stress related complaints, and contamination between the groups were monitored. Demographic measures included age, gender, fluency of written and spoken English, country of birth (UK, non-UK), relationship status, work role, number of working hours (low, middle, high), organisation, education level, income bracket and familiarity with the online environment.

4.3.5 Statistical analyses

All analyses were performed using SPSS version 22 (IBM 2013). Due to the pilot nature of this study descriptive information was presented; exploratory inferential analyses were conducted using ANCOVA and t-test as appropriate. Analyses of the primary and secondary outcome measures were conducted on an intention-to-treat basis; sensitivity analysis included a per-protocol analysis. Per-protocol was defined as three or more logins to the WorkGuru site. A significance level of 0.05 (two-sided) was used for all analyses. Cohen's d using pooled standard deviations, and 95% CIs were calculated. Effect sizes were interpreted using the classification given by Cohen (small = 0.2, medium = 0.5, large = 0.8; Cohen 1988). Outliers greater than 3.29 standard deviations away from the mean were identified (Field, 2013). Missing data was imputed using the Last Observation Carried Forward method. Baseline differences between groups were explored using chi-square and ANOVA (as appropriate).

4.4 Results

4.4.1 Recruitment and participants

Individuals (n=780) who had subscribed to a WorkGuru marketing mailing list while attending conferences were invited to nominate their organisation to take part in the research. Nineteen organisations expressed an initial interest; none of which had previous experience of WorkGuru. Six of the organisations were recruited into the study. All six organisations were UK based: two were local authorities, two were universities, one was a third sector organisation, and one was a telecommunication organisation. Participating organisations directed staff to information and promoted the study through emails, intranet, in-house magazines and newsletters. The marketing statement used by the organisations gave a brief description of the intervention and emphasised that participation would be entirely confidential.

Figure 4.1 summarises the recruitment and flow of participants through the study. Of the 135 individuals who were assessed for eligibility, 23 were excluded because they scored ≤ 19 on PSS-10, and 28 were excluded because they did not complete the baseline measure. A total of 84 individuals were randomised. Two individuals (2.4%) withdrew from the study after randomisation: one reported changing jobs and the other reported an increase in workload, which meant he/she would not have time to participate in the study.

For all the engagement measures (logins, number of pages visited, modules completed), the data was gathered through the web-based program. Two participants did not create an account for themselves, resulting in data being available for 80 of the 82 participants (97.6%). Of the 82 participants, 62 (75.6%) completed questionnaires at 8 weeks after randomisation (T2), and 70 (85.4%) 16 weeks after randomisation (T3). Of the 54 participants in active conditions, 36 (66.7%) completed the credibility and expectancy questionnaire 2 weeks after randomisation. Chi-square tests found the groups did not differ in regard to missing data (all $P > .10$). Participants who provided data at T2 and T3 did not differ from those who did not on baseline scores of depression, anxiety of stress, or on gender or allocated group.

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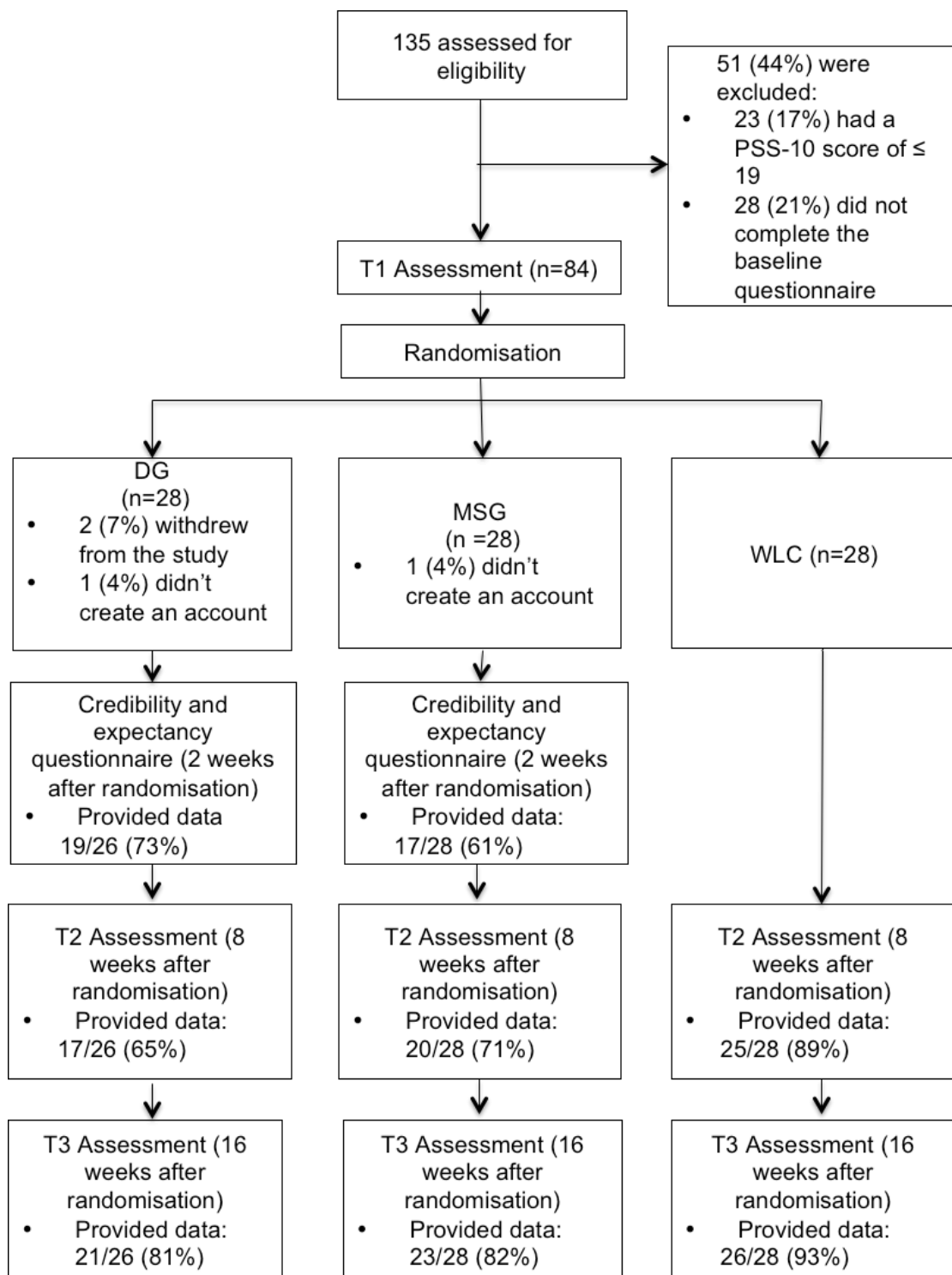


Figure 4.1: Flow of participants

4.4.2 Baseline characteristics

Demographic data for all study participants are displayed in Table 4.1. A significant difference was found between the randomised groups on both the occupation ($p = 0.013$) and the highest qualification ($p = 0.009$) variables. Sensitivity analysis was run with highest qualification as a covariate; no effect was found. No other differences were found between the groups on demographic information or levels of depression, stress or anxiety at baseline. Mean levels of depression, anxiety and stress for participants at baseline, as measured on the DASS, were moderate to severe for depression ($M = 20.2$, $SD = 9.6$) and moderate for both anxiety ($M = 12.3$, $SD = 8.1$) and stress ($M = 23.8$, $SD = 8.3$; Lovibond & Lovibond 1995).

The average age of participants was 41.0 ($SD 10.2$). The majority were female (70/82, 85%), were born in the UK (66/82, 80%), were married or living with a partner (54/82 66%), were in senior manager or administrator roles (39/82, 48%; as described by the UK National Statistics Socio-Economic Classification), and had at least a first degree (66/82, 80%). Participants had been in paid employment for a mean of 19.7 ($SD 10.5$) years. All were fluent in both written and spoken English. Most (75/82, 91%) were fairly or very familiar with the online environment. Just under half of participants (40/82, 49%) had a recent diagnosis of mental illness, with 33% (27/82) currently taking medication for anxiety or depression. Previous experience of stress management training was reported by 48% (39/82) of participants. Participants were asked on a scale of 1 to 10 (with 1 = *not important at all*, and 10 = *very important*) how important it was to them to reduce their level of workplace stress. Over 87% of participants (71/82) indicated 8 or above, with 51% (42/82) indicating the highest score. Two of the six organisations that participated in this study provided demographic information. Comparing gender information, a larger number of females participated in the study than were in the workforce (organisation 2: 52% female in the organisation, 83% of participants in the study female. Organisation 3: 67% female in the organisation, 88% of participants in the study female).

Table 4.1: Demographic information

	Total <i>n</i> =82	DG <i>n</i> =26	MSG <i>n</i> =28	WLC <i>n</i> =28
Demographic characteristics				
Gender, female (%)	70 (85)	21 (81)	24 (86)	25 (89)
Mean age (SD)	41.0 (10.2)	40.2 (9.8)	43.4 (9.9)	39.2 (10.6)
Country of birth (%)				
UK	66 (80)	23 (88)	20 (71)	23 (82)
Non-UK	15 (18)	2 (8)	8 (29)	5 (18)
Didn't say	1 (1)	1 (4)	0 (0)	0 (0)
Relationship status (%)				
Single	11 (13)	7 (27)	1 (4)	3 (11)
In a relationship	8 (10)	2 (8)	2 (7)	4 (14)
Living with partner/married	54 (66)	14 (54)	21 (75)	19 (68)
Separated, divorced, widowed	7 (9)	3 (12)	2 (7)	2 (7)
Prefer not to say	2 (2)	0 (0)	2 (7)	0 (0)
Fluency of spoken English (%)	82 (100)	26 (100)	28 (100)	28 (100)
Fluency of written English (%)	82 (100)	26 (100)	28 (100)	28 (100)
Work characteristics				
Organisation (%)				
A	7 (9)	2 (8)	1 (4)	4 (14)
B	12 (15)	4 (15)	3 (11)	5 (18)
C	17 (21)	4 (15)	5 (18)	8 (29)
D	36 (44)	13 (50)	16 (57)	7 (25)
E	3 (4)	1 (4)	1 (4)	1 (4)
F	7 (9)	2 (8)	2 (7)	3 (11)
Occupation (%)				
Modern professional occupations	15 (18)	9 (35)	2 (7)	4 (14)
Clerical and intermediate occupations	21 (26)	7 (27)	3 (11)	11 (39)
Senior managers or administrators	39 (48)	9 (35)	18 (64)	12 (43)
Technical and craft occupations	4 (5)	1 (4)	2 (7)	1 (4)

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Traditional professional occupations	3 (4)	0 (0)	3 (11)	0 (0)
Years in paid employment (SD)	19.7 (10.5)	19.0 (9.7)	20.9 (11.5)	19.0 (10.5)
Income in £ per year (%)				
10,000 - 19,000	19 (23)	7 (27)	4 (14)	8 (29)
20,000 – 29,000	25 (30)	6 (23)	9 (32)	10 (36)
30,000 – 39,000	22 (27)	5 (19)	12 (43)	5 (18)
40,000 – 49,000	12 (15)	7 (27)	3 (11)	2 (7)
50,000 – 59,000	1 (1)	0 (0)	0 (0)	1 (4)
Prefer not to say	3 (4)	1 (4)	0 (0)	2 (7)
Education level				
Highest qualification (%)				
Masters, Doctorate or equivalent	32 (39)	15 (58)	12 (43)	5 (18)
First degree or equivalent	34 (41)	8 (31)	12 (43)	14 (50)
A level or equivalent	9 (11)	2 (8)	0 (0)	7 (25)
GCSE Grade A* - C or equivalent	7 (9)	1 (4)	4 (14)	2 (7)
Experience				
Familiarity with the online environment (%)				
Very	43 (52)	16 (62)	14 (50)	13 (46)
Fairly	32 (39)	8 (31)	12 (43)	12 (43)
Moderate	6 (7)	2 (8)	2 (7)	2 (7)
A little experience	1 (1)	0 (0)	0 (0)	1 (4)
Recent diagnosis of mental illness %	40 (49)	11 (42)	13 (46)	16 (57)
Currently taking medication for anxiety or depression %	27 (33)	9 (35)	9 (32)	9 (32)
Previous training on stress management %	39 (48)	10 (38)	12 (43)	17 (61)
Notes				
DG = Discussion Group; MSG = Minimal Support Group; WLC = Wait List Control				

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4.4.3 *Engagement outcomes*

One univariate outlier was found on each of the login and the page view variables; these were replaced with the group mean in each case. Sensitivity analysis indicates that if the outliers were not removed then the effect sizes remain in the same order of magnitude as reported below, but the CI for both the mean number of logins and the mean number of pages viewed no longer cross zero.

Data for the primary and secondary engagement measures are shown in Table 4.2. The mean for each of the three engagement outcomes show a greater number of logins, modules completed and page views for the DG compared to the MSG. A medium between group effect size was observed for the primary outcome of login ($d=0.51$; 95% CI: -0.04, 1.05) and for secondary outcome page views ($d=0.53$; 95% CI: -0.02, 1.07), and a small effect size ($d=0.26$; 95% CI: -0.28, 0.80) was observed for modules completed. Confidence intervals for all outcome effect sizes crossed zero. No difference was found in the self-report engagement between the two groups.

Table 4.2: Primary and secondary outcome: Engagement of WorkGuru

Outcome	DG (n=26)			MSG (n=28)			Cohen's <i>d</i> (95% CI)
	M	SD	Range	M	SD	Range	
Logins	9.4	7.3	0 - 25	5.8	6.8	0 - 26	0.51 (-0.04, 1.05)
Modules completed	2.2	2.9	0 - 10	1.5	2.4	0 - 9	0.26 (-0.28, 0.80)
Page views	143.1	117.6	0 - 410	83.2	107.6	0 - 441	0.53 (-0.02, 1.07)
Self-report engagement	3.18	1.13	1 - 5	3.35	1.17	1 - 5	0.15 (-0.68, 0.39)

4.4.4 Psychological outcomes

Descriptive data for both psychological outcomes at all three assessment points is shown in Table 4.3. Table 4.4 shows the between group effect sizes. At T2 a small between group effect size difference was found between both active conditions compared with the WLC on all three sub-scales of the DASS. No difference was found between the two active conditions. At T3 a small effect size difference was maintained between DG and the WLC on both the anxiety and stress subscales, and a small or medium between group effect size difference was maintained between MSG and WLC on all three subscales. Confidence intervals for all outcome effect sizes on the DASS with the exception of the T3 between group effect size between the MSG and WLC on the stress subscale, cross zero.

At T3, small between group effect size differences were found between the two active conditions on both the depression and the stress subscales. Examination of the means suggests that the means for both depression and stress are smaller in the MSG.

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Findings from the IWP data suggest that there was a small effect size difference between both active conditions and WLC on the enthusiasm and comfort subscales at T2, which is maintained in the MSG group at T3, suggesting that there is an increase in enthusiasm and comfort in the active conditions and that this is maintained at T3 in the MSG group. Contrary to the DASS data, an effect size of zero or only a very small effect size was found on the depression and the anxiety subscales at T2. At T3 a small effect size difference is found on the anxiety subscale between both active conditions and the WLC. Small group effect sizes are also found at T3 between the two active conditions on both the anxiety and the comfort subscales. Examination of the means suggests that the improvements to both anxiety and comfort are in favour of the MSG group. Confidence intervals for all outcome effects sizes on the IWP measure crossed zero.

Table 4.3: Mean and standard deviation for the psychological outcomes (ITT sample)

	T1			T2			T3		
	DG	MSG	WLC	DG	MSG	WLC	DG	MSG	WLC
	(n=26)	(n=28)	(n=28)	(n=26)	(n=28)	(n=28)	(n=26)	(n=28)	(n=28)
	M	M	M	M	M	M	M	M	M
	(SD)	(SD)	(SD)	(SD)	(SD)	(SD)	(SD)	(SD)	(SD)
DASS^a									
Depression	19.9 (10.2)	20.2 (9.6)	20.5 (9.4)	16.0 (10.1)	15.1 (9.9)	18.0 (11.0)	15.5 (8.5)	13.8 (9.5)	16.0 (9.9)
Anxiety	10.8 (7.4)	12.4 (8.6)	13.6 (8.4)	10.2 (7.7)	9.3 (6.3)	12.7 (8.6)	8.8 (6.4)	7.9 (6.9)	11.0 (9.6)
Stress	23.3 (7.7)	24.0 (9.4)	24.1 (8.0)	19.8 (9.2)	19.3 (6.6)	22.4 (7.6)	18.1 (7.7)	15.9 (6.6)	20.6 (8.7)
IWP^b									
Enthusiasm	8.6 (2.8)	8.4 (3.5)	7.9 (2.4)	9.7 (3.5)	9.8 (3.7)	8.6 (3.7)	9.3 (3.7)	10.0 (4.0)	9.3 (4.3)
Anxiety	14.9 (5.5)	13.7 (5.2)	14.2 (6.1)	15.8 (5.7)	15.8 (5.6)	16.1 (5.7)	17.6 (5.5)	18.7 (5.7)	16.3 (5.9)
Comfort	7.4 (2.2)	7.6 (2.7)	7.7 (2.3)	8.6 (3.2)	8.6 (3.2)	7.9 (3.0)	9.5 (3.3)	11.0 (5.1)	9.0 (3.7)
Depression	18.0 (5.7)	17.0 (5.3)	17.8 (5.1)	18.7 (5.8)	19.3 (6.5)	19.3 (5.7)	19.7 (6.3)	20.7 (6.0)	20.0 (6.2)

^a Lower scores = higher wellbeing^b Higher scores = higher wellbeing

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Table 4.4: Between groups effect sizes for psychological outcomes (ITT sample)

	T2 between group effect			T3 Between group effect		
	Cohen's d (95% CI)					
	DG & WLC	MSG & WLC	DG & MSG	DG & WLC	MSG & WLC	DG & MSG
DASS						
Depression	0.19 (-0.35, 0.72)	0.28 (-0.25, 0.80)	0.09 (-0.45, 0.62)	0.05 (-0.48, 0.59)	0.23 (-0.30, 0.75)	0.19 (-0.35, 0.72)
Anxiety	0.31 (-0.24, 0.84)	0.45 (-0.09, 0.97)	0.13 (-0.41, 0.66)	0.27 (-0.27, 0.80)	0.37 (-0.16, 0.89)	0.14 (-0.67, 0.40)
Stress	0.31 (-0.23, 0.84)	0.44 (-0.10, 0.96)	0.06 (-0.60, 0.47)	0.30 (-0.24, 0.84)	0.61 (0.06, 1.14)	0.31 (-0.84, 0.23)
IWP						
Enthusiasm	0.30 (-0.84, 0.23)	0.32 (-0.20, 0.85)	0.03 (-0.51, 0.56)	0 (-0.53, 0.53)	0.17 (-0.36, 0.69)	0.18 (-0.35, 0.72)
Anxiety	0.05 (-0.59, 0.48)	0.05 (-0.58, 0.47)	0.00 (-0.53, 0.53)	0.23 (-0.31, 0.76)	0.41 (-0.12, 0.94)	0.20 (-0.34, 0.73)
Comfort	0.23 (-0.76, 0.31)	0.23 (-0.75, 0.30)	0 (-0.53, 0.53)	0.14 (-0.68, 0.39)	0.45 (-0.98, 0.08)	0.35 (-0.19, 0.88)
Depression	0.10 (-0.64, 0.43)	0.00 (-0.52, 0.52)	0.10 (-0.44, 0.63)	0.05 (-0.58, 0.49)	0.00 (-0.52, 0.52)	0.16 (-0.37, 0.70)

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4.4.5 *Per-protocol analysis*

Per-protocol analysis was conducted using data from participants who had logged into the program ≥ 3 times, and who had completed questionnaires. Protocol adherence was achieved by 70% of participants. Per-protocol analysis mirrored the effect size for the primary outcome number of logins ($d = 0.42$, 95% CI: -0.22, 1.05). Results for the DASS showed larger effect sizes: at T2 a medium to large between group effect size was found between both active conditions and the WLC on all subscales of DASS, small to medium effect sizes were maintained at T3. The between group effect sizes for MSG and WLC at both T2 and T3 for the subscale stress were both significant effect sizes (T2: $d = -0.76$, 95% CI: -1.41, -0.09; T3: $d = -0.64$, 95% CI: -1.25, -0.01). The confidence intervals for all the other effect sizes crossed zero. At T3 a small to medium between group effect size was found between both the active conditions with the mean scores showing a lower level of depression, anxiety and stress for the MSG, confirming the findings in the ITT analysis that while participants in both active conditions have reduced levels of stress, depression and anxiety, participants in the MSG seem to benefit most from the intervention.

Per-protocol analysis of the IWP data were consistent with the ITT analysis but showed larger effect sizes: a medium effect size difference was found between both active conditions and the WLC on both the enthusiasm and comfort subscales, at T3 a small effect size was maintained between MSG and WLC, confirming the finding that there was an increase in enthusiasm and comfort in the active conditions and that this was maintained in the MSG group at T3. At T3 a small to medium effect size was seen on all the subscales between the MSG and WLC. Examination of the means show an increase in enthusiasm and comfort and a decrease in depression and anxiety in favour of the MSG. A small effect size difference was found on all the subscales at T3 between the two active conditions. The mean scores confirm the ITT findings that participants in the MSG seemed to benefit most from the intervention. Confidence intervals for all outcome effect sizes on the IWP measure crossed zero.

4.4.6 *Client satisfaction, usability, acceptability and credibility*

At T2 all of the 17 participants in the DG and only 17 of the 20 participants in the MSG group who provided data completed the client satisfaction and system usability questionnaires. Client satisfaction with WorkGuru was high, with 82% (14/17) in the MSG and 71% (12/17) in the DG rating the service that they had received as excellent or good. The majority of participants said that they had got the kind of service that they wanted (76% in both groups 13/17), and that they would recommend the program to a friend (MSG: 65% 11/17; DG: 76% 13/17). Participants in the MSG were more satisfied with the amount of help that they received (MSG: 76% 13/17; DG: 59% 10/17) and their general satisfaction with the service appeared to be higher (MSG: 76% 13/17; DG 65% 11/17). They were more likely to say that the service helped them to deal with their problems (MSG: 76% 13/17; DG 53% 9/17) and that they would come back to WorkGuru if they needed help again (MSG 71% 12/17; DG 47% 8/17). A small number of participants (MSG: 12%, 2/17; DG 18%, 3/17) said that none of their needs had been met, and one participant (6%) in the DG said that the service seemed to have made their problems worse. The mean system usability score for DG was 68.4 (SD 15.8) and for MSG 76.0 (SD 13.5).

Participants in both active conditions were given the CEQ at 2 weeks from randomisation. Intervention credibility and expectancy of participants about improvements was similar across both groups (mean credibility for DG = 15.4 (SD = 3.7) and for the MSG = 16.3 (SD 3.9); mean expectancy for DG = 12.2, (SD = 5.2) and for the MSG = 14.8 (SD = 5.5)).

4.4.7 *Sickness absence*

Participants were asked at all three time points if they had taken time off sick for a stress related complaint in the last eight weeks. All groups had seen a fall between T1 and T3 in the number of participants who had been absent from work. For the DG the mean at T1 was 15% (4/26), at T2 18% (3/17), and at T3 5% (1/22). For the MSG it was T1 25% (7/28), at T2 0% (0/28), and T3 13% (3/23). For the WLC it was T1 29%

(8/28), at T2 32% (8/25) and T3 23% (6/26). Figure 4.2 shows the self-report sickness absence for stress related complaints.

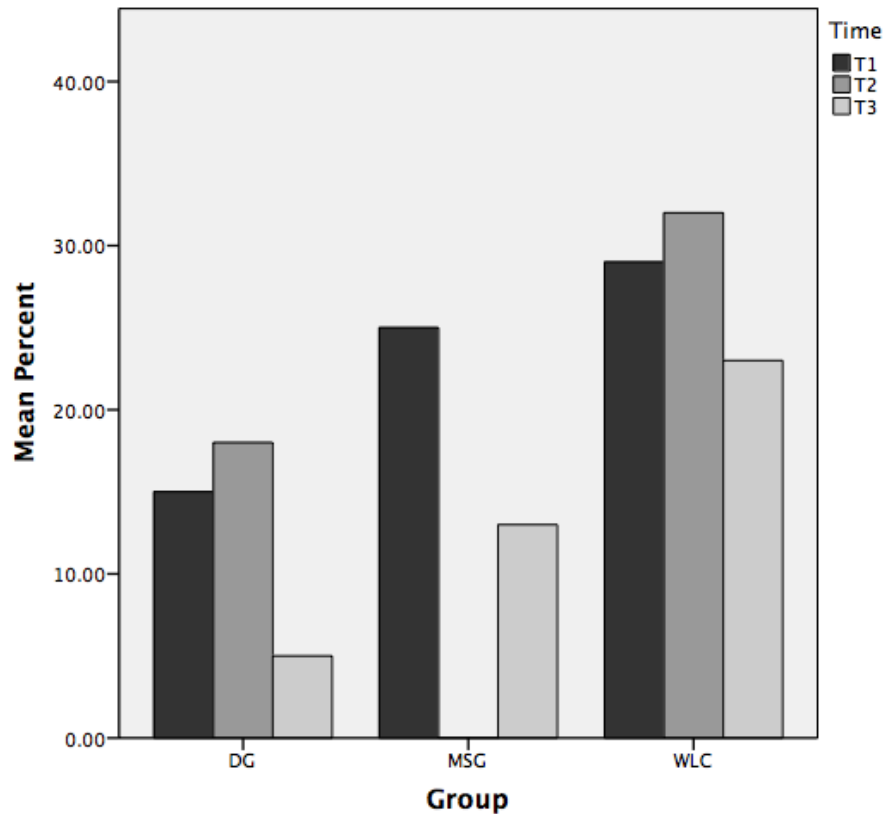


Figure 4.2: Have taken time off sick for stress related complaint in last 8 weeks

4.4.8 Care As Usual

Self-reported care as usual was examined to see if there were any differences between the three groups at the three time points. Participants accessed a range of support for their mental health problems including from GPs, counsellors, online self-help (e.g. a website for information), psychiatrists, psychologists, occupational health nurses and doctors. No differences were found between the groups on the number or type of support accessed, or the number of participants who had been prescribed medication for anxiety or depression. A similar number of participants across the groups reported accessing online support for information.

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4.4.9 Moderator analysis

Possible moderators of engagement were explored. The means for participants on goal conflict, time pressure, job autonomy and level of psychological distress (total of DASS subscales) at baseline were calculated and the participants placed in groups depending on whether they were above or below that mean. Table 4.5 shows the mean number of logins for each of the groups and the between group effect sizes. The analysis showed a small effect size for goal conflict ($d = 0.22$, 95% CI: -0.75, 0.32), time pressure ($d = 0.19$, 95% CI: -0.73, 0.35) and level of psychological distress ($d = 0.43$, 95% CI: -0.93, 0.12) at baseline. Examination of the means suggested that participants who reported lower goal conflicts, lower time pressure and lower psychological distress at baseline had a higher number of logins to the stress management program. No effect size difference was found between the two groups for job autonomy. Confidence intervals for all moderator analysis effect sizes crossed zero.

Table 4.5: Moderator analyses

Moderator (n)	Mean number of logins	SD	Cohen's <i>d</i> (95% CI)
Goal conflict			
Conflicted (26)	6.7	5.8	0.22 (-0.75, 0.32)
Non-conflicted (28)	8.3	8.4	
Time pressure			
Time pressured (22)	6.7	6.0	0.19 (-0.73, 0.35)
Not time pressured (32)	8.1	8.0	
Job autonomy			
Autonomous (30)	7.5	5.7	0.00 (-0.54, 0.54)
Non autonomous (24)	7.5	8.9	
Level of psychological distress at baseline			
Higher distress (33)	6.3	6.2	0.43 (-0.98, 0.12)
Lower distress (21)	9.4	8.4	

4.4.10 Exploratory analyses

Further exploratory inferential analysis was conducted on per-protocol data. No significant differences were found in *t*-tests between the active conditions on the number of logins, page views, messages sent by and to the coach and the number of modules completed. The ANOVA showed a significant effect of intervention on levels of stress at T2: $F(2, 53) = 3.19, p = .049$. Contrasts show that stress levels were significantly different for participants in both DG ($t(53) = 2.0, p = .050$) and MSG ($t(53) = 2.2, p = .033$) compared to WLC. This difference was maintained at T3 in MSG ($t(59) = 2.2, p = .032$). No other significant difference was found on the psychological measures.

4.4.11 Discussion group

Two eight-week guided discussion groups were delivered via a bulletin board. The first group had 16 participants and the second group had 10. The second group started five weeks after the first group started. The bulletin board was viewed 493 times by participants ($M = 19.0$, $SD = 19.9$) and 99 contributions were made: 57 by participants and 42 by the coach. The mean number of contributions made per participant was 2.2 ($SD = 2.4$). An approximation of the time spent by the coach on each contribution that she made is 15 minutes; additionally approximately 30 minutes per week was spent by the coach logging in and monitoring each of the groups. This equates to just over five hours per group spent by the coach in contributing to the discussion and four hours per group on monitoring, which is slightly more than 1 hour of coach time per group per week or 41.5 minutes per participant across the eight-weeks.

Results from the online support group questionnaire (Table 4.6) in which items were rated on a score of 1 – 10 where 1 means *not at all* and 10 means *very much*, indicated that participants were not very satisfied with the groups. Only two items rated at over 5 these were agreement that participants preferred to use aliases, and the relevancy of the topics chosen by the coach.

Table 4.6: Means and standard deviations of the DG's online support group questionnaire

Subscale	M	SD
Support		
Felt supported by other members	3.1	2.3
Felt listened to by other members	3.2	2.2
Relevance		
Contributions of other group members were relevant	4.1	2.9
Topics of coach is relevant	5.1	2.8
Others addressed issues I raised	2.9	1.9
Comfort-connection		
Comfortable contributing to group	4.7	3.3
Felt connection to other members	2.4	1.7
Satisfied with being part of a group	3.1	2.2
Prefer aliases to real identities	5.6	3.8
Total	3.8	2.3

Note: Items scored on a range from 1 (*not at all*) to 10 (*very much*). $n = 14$

4.4.12 Coach activity

During the course of this study, across both active conditions combined, the coach sent 185 individual coaching messages through the secure system ($M = 3.6$, $SD = 1.1$) and received 43 messages ($M = 0.8$, $SD = 1.6$) from participants. The content of the messages sent from participants were: acknowledging contact from the coach ($n = 16$), reflecting on the content of the modules ($n = 12$), sharing assignments ($n = 5$) asking a technical question ($n = 4$), requesting extended access to the site ($n = 2$), explaining absence ($n = 2$), and questions about the research ($n = 2$). Messages sent by the coach at initial log-on, two weeks and six weeks were based on a template, but personalised where possible. All responses to enquiries initiated by participants were personalised. An approximation of time spent by the coach on each message is 5 minutes, this equates to 15.4 hours across the 8-week course spent by the coach on sending messages to participants in both the active conditions. The coach spent 18.7 minutes per participant

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sending, reading and responding to messages from the DG, and 17.0 minutes per participant in the MSG group.

In the DG ($n = 25$) the mean number of messages sent by the coach directly to participants (not through the bulletin board) was 3.7 ($SD = 1.1$), and in the MSG ($n = 27$) it was 3.4 ($SD = 1.1$). In the DG the mean number of messages sent by participants to the coach was 1.3 ($SD = 1.9$), in the MSG it was 0.37 ($SD = 1.0$). There is a small between group effect size for the number of messages sent by the coach ($d = 0.28$, 95% CI: -0.27, 0.82) and a medium between group effect size for the number of messages sent by participants ($d = 0.62$, 95% CI: 0.07, 1.18) suggesting that more messages are sent by both the coach and participants in the discussion group.

4.4.13 Negative effects

Participants were asked what if any positive or negatives effects were caused by being in an active condition or being in the control. Across both T2 ($n=17$) and T3 ($n=21$) participants in the DG identified eight positive effects and 13 negative effects (this included duplication where participants made the same comment at both time points). Across both T2 ($n=20$) and T3 ($n=23$) participants in the MSG identified 9 positive effects and 7 negative effects (this included duplication). Across both T2 ($n=25$) and T3 ($n=26$) the WLC identified 3 negative effects (this included duplication). Positive effects included: *It made me think/ know myself better* ($n=7$), and: *I liked the support from the coach/community* ($n=3$). Negative effects included: *I didn't have time to complete it* ($n=8$), *I found it stressful* ($n=5$) and: *I felt guilty for not using it enough* ($n=3$). The negative effects of being in the control were: *Disappointment at being in the control* ($n=2$) and: *Not having any contact with the coach* ($n=1$).

4.4.14 Contamination

The extent of contamination between the groups was monitored by asking the extent to which participants had discussed the research with colleagues in other groups. At T2

94% (58/62) of participants said *not at all* and 6% (4/62) said a little bit. At T3 87% (62/71) said not at all and 13% (9/71) said *a little bit*.

4.5 Discussion

4.5.1 Principal findings

Results of this study support the effectiveness of an online facilitated discussion group in increasing the number of logins to a minimally supported digital stress management program. Medium between group effect sizes were found for both logins and page views, and a small effect size for modules completed. No difference was found in self-reported engagement between the groups. Both the numbers of logins and page views seem to be a more sensitive measure of physical engagement with the program, but metrics such as login and page views may not necessarily measure the extent to which participants are psychologically engaged; clicking through a large number of pages may be a sign of disengagement as participants are not necessarily taking the time to engage psychologically with the content of the page. Self-report measures may be a more useful measure of engagement as they provide the user's assessment of their experience (O'Brien & Toms 2009), but it is unlikely that the one-item self-report engagement measure developed for this study is sensitive enough to give a meaningful measure of the individual's experience.

4.5.2 Psychological outcomes

Results from this study suggest that the trend appears to be that access to the web-based stress management intervention is associated with lower levels of depression, anxiety and stress, and an increase in comfort and enthusiasm compared with the control condition and that these outcomes are largely maintained at follow-up. Participants who accessed the intervention without the discussion group seem to have potentially derived greater benefit. Per-protocol analysis confirms these findings. Further research may usefully explore this possibility by examining the influence of engagement within the individual groups. The effect sizes for the DASS outcomes in this study are in line with

those reported in recent meta-analyses on digital stress management interventions (Heber et al., 2017) and digital mental health interventions delivered in the workplace (Carolan et al., 2017).

4.5.3 Satisfaction, usability, acceptability and credibility

Satisfaction with the intervention, and intervention usability was higher in the MSG than the DG. The intervention credibility and the expectancy of participants about improvements were similar across both active conditions, but satisfaction with the discussion groups was low. When recruiting to the study the intention was to run one discussion group of 30 participants (Carolan et al., 2016). The size of the discussion group was based on previous experience at WorkGuru that suggested that a group of 30 optimised participant engagement. Because of the time that it was taking to recruit to the study, the decision was made to run two groups so that participants would not have to wait for more than three weeks for their group to start. When the group had started, new recruits were still able to join the group over the first two weeks. The smaller size of the groups, the delay in the groups starting, and the experience of participants joining the groups after they had started may have impacted on both the satisfaction with the groups, and the effectiveness of the groups in optimising engagement. Because of these problems with the study design we would suggest that our findings that participants accessing the intervention without a discussion group benefited most from the intervention be interpreted with caution, and that further research is conducted to examine the optimum size and other optimising factors for facilitated discussion groups delivered alongside minimum support interventions.

4.5.4 Moderator analysis

A small effect size difference was found between participants that reported both higher and lower levels of goal conflict, higher and lower levels of time pressure, and higher and lower levels of psychological distress at baseline. Examination of the means suggested that participants who reported lower goal conflicts, lower time pressures and lower distress login to the intervention more frequently. Organisations participating in

this research were encouraged to offer participants one hour a week to complete the program. Employers were not aware of which of their employees were participating in the study so it is unlikely that this message was reinforced to individual participants. Future research could look at whether within an occupational setting, prioritising and setting aside time for individual employees to access digital mental health programs increases the number of times that participants login to the intervention.

4.5.5 Explorative analysis

The explorative inferential analysis confirmed our finding that access to the intervention resulted in a significant reduction in levels of stress at T2 and that this was maintained in the MSG at T3. In recognition that this is a pilot study, we suggest caution in interpreting these findings.

4.5.6 Coach activity

For both the active conditions combined the coach spent a total of 15.4 hours sending messages and responding to messages from participants, an additional nine hours per group was spent by the coach monitoring and contributing to the on-line discussion groups. If you combine the amount of coach time spent per participant in facilitating the two discussion groups (41.5 minutes) with the time spent per participant sending, reading and responding to messages (DG=18.7; MSG=17.0) then each DG participant required a mean of 60.2 coaching minutes, and each MSG participant required a mean of 17.0 minutes. Group means and between group effect sizes show that more messages (outside of the bulletin board) were sent between the coach and participants in the DG compared to the MSG suggesting that the additional time spent by the coach facilitating the discussion group does not result in less individual messages being sent; the discussion group may generate additional individual contact with the coach.

4.5.7 Negative effects

Participants were asked what if any negative effects were caused by being in the group that they were allocated to. Participants in the DG identified almost twice as many negative effects of being in the group than the MSG. Some participants felt that the demands of the online program increased their feelings of stress as they felt guilty for not using the program enough, or felt that they didn't have time to complete it. Being in the group that accessed WorkGuru alongside a discussion group seems to have added to that strain. Further research is needed to gain a greater understanding of the extent to which the workplace is a suitable environment for delivering digital mental health programs. Do the benefits of digital mental health that have been identified in community and health settings (e.g. the ability to access at a time and at a pace that is convenient to the user) translate as benefits in an occupational setting? Or are there additional challenges to delivering these interventions in the workplace (e.g. stigma, time pressure, competing priorities) that need to be overcome?

4.5.8 Learning from this pilot

This pilot study has enabled us to make a more confident but still tentative prediction of effect size for our primary outcome of engagement, we recognise however the limitations of using this effect size to determine sample size for a full trial (Leon, Davis, & Kraemer 2011). The pilot supports optimal adherence to the intervention as being ≥ 3 logins, and it supports the number of login and page view as being a useful measure of exposure to the intervention. Module completion does not appear to be a useful measure; this may be because exposure to anything less than 100% of the module would not register as module completion whereas participants may benefit from the module without having visited every page. A subjective measure of engagement does appear to be useful, but a more comprehensive measures than the one item measure for this pilot should be used. IWP does not seem to be a measure that is sensitive to the between group changes intended by this CBT based stress management program, a future study should explore using an alternative measure of occupational outcome (e.g. work engagement or productivity).

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One of the challenges of running this pilot study was the recruitment of organisations; out of 780 invitations to individuals to nominate their organisation to participate in the study, 19 organisations expressed an interest and six organisations were recruited. One explanation for this low take-up by organisations may be that the individuals on the mailing list were not in the position of authority or influence needed to put forward their organisation for the research. Between them, the six organisations taking part in the study recruited 84 participants; a future study may need to spend more time with organisations supporting them to maximise their recruitment of participants. Thought also needs to be given to recruiting into the discussion groups in order to minimise the wait for the groups to start and to ensure that a larger number of participants are recruited to each group. Increasing the speed of recruitment may provide a solution.

4.5.9 Limitations

This study had a number of limitations. The first was a limitation of randomising at the level of the individual, which is the potential for contamination between groups: participants in the active conditions discussing the content of the intervention with the WLC. There is no evidence of contamination at T2 but there is some evidence that between group conversations had taken place at T3. A second limitation was the generalisability of our findings: participants recruited to this study were volunteers who had increased levels of stress, and were predominantly well educated females working in social care or the knowledge industry in senior manager or administrator roles, this is not representative of the general workforce. There is a strong need for future research on occupational digital mental health interventions to target industries and occupations that are traditionally underrepresented in these studies, this includes employees working in blue-collar roles. Only two of the three participating organisations were able to provide demographic data to make a comparison between their workforce, and employees recruited to the study. This information was further limited by a difference between the metrics used by organisations and the metrics used in this study. Future research should work with organisations to collect comparable demographic data so that a better comparison can be made between the workforce and study participants. A third limitation was the recruitment of a targeted population: participants with elevated levels

of stress. Targeting these interventions towards individuals who are perceived to be experiencing stress may add to the stigma of mental health programs impacting on reach and up-take. Future studies may wish to evaluate similar programs with universal populations. Fourthly, some of the measures used in this study were developed or adapted for the study (ie the acceptability and the goal conflict measure), and were found to have relatively low reliability, which may impact on the strength of our findings. Fifthly, a failure in randomisation in the occupational groups could have effected the outcomes, we would expect a larger study to correct that. Sixthly, the measures of engagement used in this study were (with the exception of a limited self-report measure) confined to measures of exposure (i.e. number of login and pages viewed) future studies of occupational digital mental health interventions may wish to utilise more comprehensive measures of program engagement. Finally, we recognise the limitations of generalising conclusions from this pilot study and would suggest caution in interpreting our findings.

4.5.10 Conclusions

The findings of this study suggest that access to an online facilitated discussion group increases engagement with a minimally supported occupational digital mental health intervention (as defined by number of logins) but that this increase does not necessarily result in improved psychological outcomes or increased satisfaction when compared to access to the CBT based stress management intervention on its own. Access to the stress management program resulted in lower levels of depression, anxiety and stress and an increase in comfort and enthusiasm post intervention that were largely maintained at follow-up.

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5 A qualitative study of employees' perspectives on engaging with digital mental health interventions in the workplace.

Carolan, S., & de Visser, R. O. (2018). Employees Perspectives on the Facilitators and Barriers to Engaging With Digital Mental Health Interventions in the Workplace: Qualitative Study. *JMIR Mental Health*, 5(1): e8. DOI:10.2196/mental.9146

5.1 Abstract

Background: Prevalence rates of work-related stress, depression, and anxiety are high, resulting in reduced productivity and increased absenteeism. There is evidence that these conditions can be successfully treated in the workplace, but take-up of psychological treatments among workers is low. Digital mental health interventions delivered in the workplace may be one way to address this imbalance, but although there is evidence that digital mental health is effective at treating stress, depression, and anxiety in the workplace, uptake of and engagement with these interventions remains a concern. Additionally, there is little research on the appropriateness of the workplace for delivering these interventions or on what the facilitators and barriers to engagement with digital mental health interventions in an occupational setting might be.

Objective: The aim of this research was to get a better understanding of the facilitators and barriers to engaging with digital mental health interventions in the workplace.

Methods: Semistructured interviews were held with 18 participants who had access to an occupational digital mental health intervention as part of a randomized controlled trial (RCT). The interviews were transcribed, and thematic analysis was used to develop an understanding of the data.

Results: Digital mental health interventions were described by interviewees as convenient, flexible, and anonymous; these attributes were seen as being both

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facilitators and barriers to engagement in a workplace setting. Convenience and flexibility could increase the opportunities to engage with digital mental health, but in a workplace setting they could also result in difficulty in prioritizing time and ensuring a temporal and spatial separation between work and therapy. The anonymity of the Internet could encourage use, but that benefit may be lost for people who work in open-plan offices. Other facilitators to engagement included interactive and interesting content and design features such as progress trackers and reminders to log in. The main barrier to engagement was the lack of time. The perfect digital mental health intervention was described as a website that combined a short interactive course that was accessed alongside time-unlimited information and advice that was regularly updated and could be dipped in and out of. Participants also wanted access to e-coaching support.

Conclusions: Occupational digital mental health interventions may have an important role in delivering health care support to employees. Although the advantages of digital mental health interventions are clear, they do not always fully translate to interventions delivered in an occupational setting and further work is required to identify ways of minimizing potential barriers to access and engagement.

5.2 Introduction

5.2.1 Background

Nearly 1 in 3 workers in Europe report that they are affected by work-related stress, which is estimated to cost between 3% and 4% of gross national product [1]. Along with a societal and individual cost, common mental health problems such as stress, depression, and anxiety have a cost to organizations. They are associated with reduced productivity [2-5], early retirement [6], increased sickness absence [7-8], presenteeism (not working at capacity while at work) [9], and staff turnover through health-related job loss [10]. There is evidence that these conditions can be successfully prevented and treated in the workplace [11-14], but take-up of psychological treatments among workers is low, resulting in many workers going untreated [2,15,16]. One way of

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increasing workers' access to psychological treatments might be through the use of digital mental health interventions in the workplace. A recent meta-analysis found that these interventions are effective in increasing psychological well-being and workplace effectiveness but that the mean intervention completion (the extent to which participants adhered to the intervention) was 45%, with a range of 3% to 95% [17]. Although there are examples of occupational digital mental health interventions that have achieved good adherence [18-21], uptake of and engagement with these interventions in the workplace clearly remains a pressing concern.

Researchers cite a number of advantages to digital health interventions compared with traditional face-to-face interventions: these are often described as the anonymity and accessibility of the Internet with clients being able to access treatment at a time, a place, and at a pace that is convenient to them [22-24]. These advantages have led digital health interventions to being described as being well suited for the workplace [25], but with occupational digital mental health interventions still being in their infancy, little research has been done to see if these perceived advantages translate to an occupational setting; furthermore, little research has been done on the barriers and facilitators to take up and engagement with digital health interventions in a workplace setting.

The study reported here used qualitative interviews to increase understanding of the experiences of participants using an occupational digital mental health intervention as part of a randomized controlled trial (RCT). Combining quantitative and qualitative data is recommended as an effective means of getting a better understanding of new and innovative technologies [26] and other interventions [27].

The RCT compared access to a Web-based stress management intervention (WorkGuru) with and without access to an online facilitated discussion group. Full details of the trial are reported elsewhere [28,29]. WorkGuru is an 8-week modular program that is based on the principles of cognitive behavioral therapy (CBT), positive psychology, mindfulness, and problem solving. The intervention can be accessed on a secure platform on a computer or smartphone. There are 7 core modules and 3 optional modules. People completed the modules in the order and at a pace that they chose. The

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modules consisted of educational reading, interactive exercises, a stress and a thought diary, audio, and short animations. Participants could choose to share their work with an e-coach and could contact the coach for information or advice. The coach responded within 24 hours. The e-coach contacted each participant 3 times during the course of the 8-week program with reminders to login. Participants could also choose to opt-in to automated reminders (sent at a time and frequency that they chose) and a motivational message sent every Monday (the Monday morning message). Both reminders were sent by email. Along with the modules, participants could complete 8 self-monitoring standardized questionnaires.

The original trial population was recruited from 6 UK-based organizations: 2 local authorities, 2 universities, 1 third sector (not for profit) organization, and 1 telecommunication organization. Participants in the trial were randomized to 1 of 3 groups: the minimal support group (accessing the intervention with minimal support from an e-coach), the discussion group (access to the intervention with minimal support from an e-coach plus an online facilitated learning group), or the control group (access to the intervention after follow-up). Eligibility criteria for the RCT were as follows: (1) aged 18 years or over, (2) employed by a participating organization, (3) willing to engage with a digital CBT-based stress management intervention, (4) access to the Internet, (5) access to a tablet or computer, and (6) an elevated level of stress as demonstrated by a score of ≥ 20 on the ten-item Perceived Stress Scale (PSS-10) [30].

5.2.2 Research Questions

The research questions for this study were as follows: (1) What did participants see as the positives and the negatives of occupational digital mental health? (2) What helped and what hindered engagement with occupational digital mental health? (3) What more could be done to help participants engage with occupational digital mental health? (4) What did participants think a perfect digital mental health intervention would look like?

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5.3 Methods

5.3.1 Participants

All participants (n=82) recruited to the RCT were invited via email to take part in this study. Four emails were sent over a 3-week period, inviting participation in telephone interviews. Further information about the study was given. The emails emphasized that we were keen to interview participants whether or not they had logged on to the program. The final email re-emphasized our wish to interview participants who had not engaged with the program. Participants were invited to contact the first author for more information and to arrange a time for the interview. Informed consent forms were distributed and returned before the interview. Ethical approval was granted by the host university's ethics committee.

5.3.2 Data Collection

A total of 18 semistructured telephone interviews were conducted by the first author in May 2017. Each interview lasted between 20 and 50 min. The interview questions were informed by previous literature, experience from the RCT, and the study aims. The final question used a solutions focus approach (see [31]) to invite participants to imagine a perfect occupational digital mental health intervention. Participants received and were asked to read a participant information sheet informing them about the study, and they were asked to sign and return a consent form or give audio-recorded informed consent before the interview takes place. Interview recordings were transcribed verbatim and anonymized.

5.3.3 Data Analysis

Thematic analysis as described by Braun and Clarke [32] was used to develop an understanding of the data. The 6 phases of thematic analysis described by Braun and Clarke [32] are as follows: (1) familiarize yourself with the data, (2) generate initial codes, (3) search for themes, (4) review themes, (5) define and name themes, and (6) produce the report. Microsoft Excel (2011) was used to organize and manage the data.

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Both authors independently reviewed and coded a subset of the transcripts and discussed and resolved any inconsistencies to arrive at a shared interpretation of the data. The first author coded the remaining transcripts, which were reviewed by the second author for inconsistencies. Identifier pseudonyms were used.

5.4 Results

5.4.1 Recruitment and Participants

A comparison between the study participants and the original trial participants is given in Table 5.1. All participants were white. The sample was, on average, older (45 years compared with 41 years) and included less female participants (78% compared with 85%) than the original study. Recruitment from the universities and the telecommunication organization was broadly similar, but more participants were recruited from the third sector organization, and we were not able to recruit any participants from the 2 local authorities. The number of people in this study who recalled being randomized to the control group was representative of the original study, but the number that recalled that they had been randomized to the minimal support group was higher, and to the discussion group lower. Of the 18 participants in this study, 14 respondents (78%) reported that their work was predominantly office based; the remaining 4 (22%) reported a mixture of office and client work.

Table 5.1: Comparison of participants in this study and the original trial.

Comparison variable	Participants in this study (N=18)	Participants in RCT ^a (N=82)
Mean age (SD)	45 (10.8)	41 (10.2)
Female, n (%)	14 (78)	70 (85)
Organization, n (%)		
Third sector	7 (39)	17 (21)
Universities	10 (56)	48 (58)
Telecommunications	1 (5)	3 (4)
Local authority	0 (0)	14 (17)
Allocated group, n (%)		
Discussion group	4 (22)	26 (32)
Minimal support group	8 (44)	28 (34)
Wait list control	6 (33)	28 (34)

^aRCT: randomized controlled trial.

When participants were asked whether they thought they had engaged well with the intervention, 7 (39%) said they had engaged well, 8 said no or not very well (44%), and 3 had never logged into the intervention (17%). Participants were also asked to recall how many times they had logged into the program. The mean number of logins recalled by participants who said that they had engaged well with the intervention was 15.0 (range 4-30); the mean number for those who recalled that they had not engaged well was 9.8 (range 5-20).

All participants who accessed WorkGuru did so during working hours (including their lunch break), with only 2 saying that they also accessed it outside working hours. The initial trigger for accessing the intervention was described as current experience of stress, with a number of participants saying that the opportunity to use it arose at the right time. Participants said that they were looking for tools to help them cope with their stress. Moreover, 14 (78%) of the people interviewed for this study said that they had never used a digital health intervention before using WorkGuru. Of the remaining 4

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participants, 3 had used a pedometer, 1 used a mood tracker, 1 monitored his or her sleep, and 1 participant accessed YouTube videos designed to help people sleep.

A total of 6 key themes were derived from the analysis: the positives and negatives of digital mental health; the facilitators and barriers to engagement; the role of the e-coach; and what made a perfect occupational digital health intervention.

5.4.2 *The Positives of Digital Mental Health Interventions*

Participants described digital mental health interventions as being convenient both in terms of accessing it at a time that is convenient for them and at a place that is convenient for them. The quote below reflects participants' appreciation of these characteristics:

Whenever I need something I can just straight away go there without waiting for someone, waiting for an appointment or like. I can get help as soon as possible and I can get it anywhere because it's online on the Internet. [Sara, 31 years, university one]

Another aspect of this convenience identified by participants was the ability to work at a time that was convenient to them. Natalie [40 years, third sector] noted that the intervention gave "flexibility to access the intervention at a time that you can fit into your work diary." This meant that they could fit sessions in when they had time rather than having to fit with the timetable of a (potentially busy) therapist. Robert also appreciated the flexibility of access and talked about the importance of being able to work at his own pace:

It's incredibly accessible both in terms that I could chose when I was engaging with it, and it allowed me therefore to kind of pace myself and reflect on things and then go back to things when I wanted to rather than saying: "Well you've got a session, it's at 2 o'clock on a Friday and that's it, that's your only window". So I think it made it in some senses more live for me rather than an event that you go to. [Robert, 46 years, university one]

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Participants identified the stigma of mental illness as still being an issue in the workplace. One participant said:

I wouldn't tell it to anyone in my workplace. [Sara, 31 years, university one]

Another participant described how she would not talk to her employer about the elements of work that contributed to her stress as:

I would then be forever seen as someone who doesn't cope well and then wouldn't get much career progression. [Sue, 43 years, university two]

Participants suggested that the discreteness and anonymity of digital mental health interventions helped them to overcome their fear of the stigma:

I think also it's very discreet. If you have to shuffle off and actually see somebody you know face to face, it's a bit more public, people are more likely to know about it. [Fiona, 62 years, third sector]

The privacy of the Internet allowed participants to access support without work colleagues knowing. For example, Simon [48 years, university two] noted that the intervention allowed him to “get the support without necessarily drawing attention to myself at work.” Anonymity was also given by not having to call someone to make an appointment:

Personally it was easier to say, “I'm doing something to help myself”, but without actually having to speak to someone. You know it's quite daunting if you've got a worry to actually pick up the phone and speak to someone. [Anna, 47 years, third sector]

Anna found it easier to start the digital intervention because she did not have to speak to someone to make an appointment; other participants shared this view and suggested that by having access to a Web-based intervention they were able to access treatment, which they might not have done if they had to speak face-to-face with someone:

I felt quite positive about starting it off when it's not something I would've done if I'd had to go and physically speak to somebody about it. [Tony, 56 years, third sector]

Some participants valued being able to access the intervention in the workplace. This feature enabled them take time out of stressful events at work to focus on themselves:

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To be able to in a workplace setting after dealing with a particularly stressful case, being able to remove yourself and do something just for you with permission from your employer, was really an empowering tool that they gave us. [Jane, 28 years, third sector]

Jane valued being able to access the intervention in the workplace, but other participants identified a number of barriers to accessing digital mental health interventions at work; these are described in the next section.

5.4.3 The Negatives of Digital Mental Health Interventions

Participants identified a number of negatives to accessing digital interventions in the workplace. These included not having a defined time in which to use the intervention. Although participants appreciated the flexibility of digital mental health interventions, a number of them also felt that they needed more self-discipline to remain engaged with a digital intervention compared with a face-to-face intervention where they had an appointment in their diary and an office or clinic to visit:

It's good not to have to do things in a certain time but it's also not good because you can often think "Actually I'll do it later", and never get round to it. [...] If it's online it's down to the individual themselves to go and do what they are required to do. [Simon, 48 years, university two]

Other participants struggled with not having a private space to access the intervention:

And the other problem is sitting in an open plan, hot-desking space. In our room each desk runs into the next desk, there are no privacy screens between them. So I don't know if there's a sense of feeling that other colleagues can see what you're working on, they can see the screen of your computer. [Natalie, 40 years, third sector]

For some participants, accessing the intervention at their desks meant that they might have benefited less from it, because existing ongoing work concerns that may have been the cause of stress were present in the therapeutic environment:

If you go somewhere else to an appointment, I think on the whole you're going to get more out of it than if you're fitting it in but you're still at your desk and

you can see the invoices that need approving and your to-do list. [Katy, 63 years, university one]

In addition to the lack of a *spatial* separation between work and therapy, there was also no *temporal* separation between work and therapy. For example, one interviewee noted that accessing the digital intervention at her desk meant that she did not have the journey back to work to help her switch back to work mode:

You're doing something very reflective and personal that might make you feel uncomfortable feelings, and then to go back into work mode immediately. I guess I think even if you go to a counselling session you have that physical journey back to work which helps switch modes back and so you've got time to kind of leave those feelings behind. [Sue, 43 years, university two]

Another issue was that the workplace is often a place in which we are invested in appearing strong and capable. For example, one participant described how, although she was able to present herself positively to work colleagues, reflecting on her mental health in the workplace left her feeling exposed:

I was struggling. At work people probably wouldn't really have picked up that much was going on for me, I was quite happy to keep that going in front of people so then I'm at work and I'm...it starts you having to think about the other stuff that's affecting you internally but you're managing to put on a pretty OK persona when you're at work so then it just felt like I was having to...I didn't want to expose myself too much I suppose. [Anna, 47 years, third sector]

Several participants said that one of the problems for them with completing a minimally guided digital intervention was the lack of human interaction. Although not having to speak to someone was a positive for some people (see above), it also meant that it was easier to disengage from the intervention:

It does allow you to maybe explore these things without having to open up directly to a person. But then the downside to that is that it also allows you to walk away from it more easily. [Tony, 56 years, third sector]

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Some participants noted that not having a one-to-one interaction meant that they might choose the “easier” elements of the intervention, and therefore not obtain the benefits of more comprehensive engagement. For example, John [33 years, university two] noted that it was possible to avoid the more challenging elements that “probably had more growth behind it.” The lack of face-to-face contact also meant that participants could be left feeling isolated and feeling that they had not made an emotional connection and that they were not “*sharing*”:

I guess it's the isolation, with doing everything anonymously and just taking time out on your own to do it there's no real sharing involved in it. [Jane, 28 years, third sector]

5.4.4 Facilitators to Engagement

In addition to the convenience, flexibility, and anonymity mentioned above, the main factors that participants identified as helping them to engage with the digital intervention were program content and design. Interesting content was one reason given for engaging with the program. For example, 1 participant said:

The content I think was what kept me going back into it because it was interesting. It had interesting content. [John, 33 years, university two]

Participants liked that the program was interactive and they liked the way it was presented. The positive experience motivated them to continue:

It was in nice bite size chunks. It was well presented. It was quite enjoyable. Yeah, it was quite enjoyable to do. It was good taking yourself out of the work situation for a bit, before going back in again. So I mean it was just a very positive experience so I think that just encouraged me to carry on with it. [Claire, 57 years, university one]

Each module gave an estimation of the amount of time it would take to complete, which enabled users to plan their engagement. Participants also appreciated that the intervention tracked their progress through the program; for example, 1 participant described how being able to see what modules she had completed motivated her to complete other modules:

You can see on screen you've done this and you've done this and you've done this, but you still need to do this. It was almost like playing an online game.
[Katy, 63 years, university one]

Other features that helped participants to engage with the intervention were reminders to log in that were built into the system. These included self-timed opt-in automated emails and the opt-in Monday morning message. This was an email message sent every Monday morning that included a motivational message and information on keeping yourself psychologically well at work. It was intended as a reinforcement of the key messages in the program and a reminder to log in. Personalized reminders were also provided by the e-coach who contacted each participant to remind them to log in to the program and to contact her if they needed any support. One participant suggested that email reminders from the e-coach were more helpful than the automated reminders:

I think when I got the emails from the work coach themselves, because it was a person enquiring that was much more of a prompt to look in and go: "Oh yeah, gosh, I do need to focus in on this and make some time for it", but when it was just an automated response it kind of felt, it kind of made me feel guilty about logging in. [Jane, 28 years, third sector]

In addition to using the different reminders within the intervention, some participants described setting their own reminders by putting tasks in their work calendar. They noted that this helped them to engage with the program:

If you just think you've got forever to do it, it would have been easier to put it off whereas you know I wanted to do it so I set myself reminders and built it into my calendar. [Claire, 57 years, university one]

A number of participants identified the importance of organizations and line managers in promoting the use of interventions such as WorkGuru and encouraging the staff to use them. Natalie described how support to use the intervention from a manager could make a big difference:

If you get a message from the manager that that's ok and that they encourage and support you to do that, that can make a big difference. [Natalie, 40 years, third sector]

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Promotion by the employer gave the intervention legitimacy and gave the staff explicit permission to use it:

I think probably the fact that this was circulated by the university, it probably added a bit of...almost legitimacy about it, I guess. This was something that was supported by the university, which is probably a little bit silly but when you're in a stressed situation it is just the knowledge that yeah well the university said this is an ok thing to do, it's ok for me to take time to be working through this and it's to their benefit because if I'm working more effectively then they benefit as well. [Claire, 57 years, university one]

5.4.5 Barriers to Engagement

Over half of the interviewees identified the pressure of time or excessive workload as being the main reasons for not engaging with the intervention:

Although it was something that I wanted to do, getting [the prompt to logon] was just kind of a: "Oh god, have I really got time to do this today? Am I going to feel guilty for leaving my colleagues?" [Jane, 28 years, third sector]

Similarly, Anna [47 years, third sector] noted that engaging with the intervention "became almost a luxury", and that when work pressures were mounting "I couldn't devote the time to do it."

In addition to time pressure, the symptoms of mental health problems were identified as potential barriers to engagement. For example, Chloe noted that effective engagement required levels of motivation that may not be possessed by people with depression:

Probably at the time, um I was very low, very depressed. [...] I suppose time would've been a bit of an issue, coupled with depression. I didn't have any motivation at all. [Chloe, 44 years, telecommunication]

5.4.6 The Role of the E-Coach

Participants gave mixed reports on their use, appreciation, and expectation of the e-coach. A number of participants did not engage with the e-coach; some were unclear about what the role of the e-coach was or how they could use her support:

I thought it really helped when I did some of these exercises and like sitting and writing down the feelings that could happen or triggers. I did it a couple of times and it really helped me a lot so I don't know how to tell it to the coach. Can the coach help with this stuff or not? Also in the exercises they are there and what else can the coach help with? [Sara, 31 years, university one]

One participant said that the communication from the e-coach felt automated:

Yeah it just, it seemed like an automated thing. I didn't really, I mean obviously I thought if you sent them an email it would get through to someone but um it just didn't feel very personal I guess. [Rose, 38 years, university one]

However, another participant had a more positive experience:

I actually found the initial contact, really really, almost like validating. I was an individual I wasn't just a number, which I kind of really, really...really impressed me. [Robert, 46 years, university one]

Participants were also divided about how proactive they wanted the e-coach to be. Some participants were happy that the e-coach was there if they wanted to ask any questions or “if I’ve got a specific query” [Claire, 57 years, university one]. Other participants wanted more contact with the e-coach:

I think it would be useful to have something a bit more proactive near the front just to try and ensure people really were comfortable with what they were doing. [Tony, 56 years, third sector]

5.4.7 What Would a Perfect Digital Intervention Look Like?

When asked to describe what a perfect occupational digital mental health intervention might look like, almost half of the interviewees said that they would want to be able to access it only on a computer, the same number said on both a computer and a smartphone, and 2 said they would like to access the intervention only on a smartphone.

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Participants wanted an intervention that would be anonymous and confidential and that could be tailored or adapted so that it could meet the needs of different people:

It's just remembering that everyone is different and everyone's moods has ups and downs, and depressions and joys are addressed in different ways and I guess a single program that takes everyone through a singular route probably doesn't hit the nail on the head. [Tony, 56 years, third sector]

Nearly all participants described their perfect intervention as combining a short course that they could work through independently with a website that had regularly updated information and personalized advice that they could make use of as required over an indefinite period:

It would be sort of as I described, a short, fairly intensive course that you were checked up on whether you'd done it or not which would really help followed by the availability continuously after that, um, just for dipping into or for necessarily contacting somebody in person if possible. [Rachel, 55 years, university one]

Interviewees said that the structure and layout of the short course should be simple, especially those who were less confident using information technology:

Yeah and it has got to be something very simple because I'm really not very technical. I am a bit of a, yeah a technology dinosaur to be honest so it would have to be very simple and accessible. [Natalie, 40 years, third sector]

They also suggested that the content of the course should be interactive and consist of a mixture of reading and listening:

It's got to be something like this [WorkGuru] ... for me anyway, something that is interactive...because that's how I engage with stuff, it can't be just reading. I like that this was a mixture of reading, listening and actually doing stuff because I think it would be very easy not to take it in if it was just reading from a screen. [Claire, 57 years, university one]

Participants were equally split between those wanting peer support as part of the time-unlimited resource and those who did not. One participant suggested that if peer support was available, she would want a small group:

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If it was going to be something that I use regularly then I would probably want a smaller peer group, as in the sort of size that was in the discussion group that was active with WorkGuru rather than it being a kind of Facebook type thing where anybody can get involved because I think that floods it, and it becomes too much to actually digest and get involved with. [Jill, 31 years, third sector]

In contrast, Rose stated that she would not use a support group for the following reason:

I'm not good with groups of people really so that's not something I'd make much use of myself. [Rose, 38 years, university one]

A number of participants suggested that monitoring, including self-report tracking of stress symptoms, would be useful but emphasized that this information should not be made available to their employer.

The majority of participants wanted to be able to contact a coach if needed. For some, that support could be asynchronistic, but others wanted live chat either through video (eg, Skype) or instant messaging. A participant said:

You kind of sense the difference between someone who is physically there the whole time and yeah they're there, they're writing an answer but it's like an email conversation. [John, 33 years, university two]

5.5 Discussion

5.5.1 Engagement With the Intervention

Only 4 interviewees said that they had used a digital health intervention before using WorkGuru. This suggests that despite the growing number of apps and websites, digital health is still a very underutilized resource. The trigger for initially accessing the intervention in this study was described by participants as a current experience of stress. This may suggest that perceived personal relevance is an important factor in initiating engagement with digital health interventions [33].

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5.5.2 *Positives and Negatives of Digital Mental Health in the Workplace*

Participants in this study described contradictions between aspects of occupational digital mental health interventions, viewing the same aspects as both advantages and disadvantages. Convenience and flexibility could increase engagement with digital mental health by increasing the opportunities to access the intervention, but within a work environment, these advantages could also be experienced as disadvantages, resulting in difficulties in prioritizing time and a lack of spatial and temporal separation between work and therapy, which left some people feeling that they had competing priorities, or left them feeling exposed as they struggled to move from therapy mode to work mode. Knowles et al. [34,35] identified similar contradictions in users' experience of digital therapies in nonwork settings. They identified contradictions in users' experience of flexibility, support, autonomy, connectedness, and anonymity in computerized therapy for depression and anxiety delivered predominantly in primary care.

In this study, the anonymity of digital health interventions was hard to maintain within an open-plan environment. Anonymity was important because it enabled participants to access help without fear of stigma and for some people it gave them the confidence to use the intervention, which they may not have done if they had to attend a face-to-face appointment or speak to their general practitioner (GP). However, other participants suggested that anonymity made it easier to disengage from the intervention. It could be argued that by removing some of the barriers to accessing face-to-face interventions such as inconvenient locations, inability to get an appointment, high cost, lack of transport, delay in access, and the fear of stigma, digital mental health may increase the number of people that take up therapy [36], but one of the effects of easing access to interventions may be increased dropout [37]. We can draw on the Prochaska and DiClemente's [38] stages of change model to illustrate this further. Prochaska and DiClemente ([38]; see also [39]) described 5 stages of behavioral change: (1) precontemplation (where there is no intention to change a behavior), (2) contemplation (where people are thinking about changing a behavior), (3) preparation (where people are intending to take action and may be taking small steps toward it), (4) action (where people are taking action), and (5) maintenance (where people work to prevent relapse).

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People who have made an appointment to attend a face-to-face intervention are more likely to be in the action stages of change, whereas people accessing digital interventions may also be in the contemplation and preparation stages of change. They may be accessing the intervention out of curiosity—a wish to explore the possibility without making a commitment. This means that they may move back to the contemplation or preparation stages of the change model and may wish to access the digital intervention or another form of psychological intervention at a later date. In widening access to therapies, digital mental health interventions may be the first step in someone's therapeutic journey, and as such, disengagement should not necessarily be seen as a failure but as part of a process of seeking help. Our current data do not allow us to identify which users of digital mental health interventions are in which stage of the change model; future research may wish to explore this further to gain a better understanding of the role digital mental health interventions play in enabling people to access support and to change behaviors.

Along with being able to disengage from the intervention more easily, one of the other potential disadvantages of the lack of face-to-face contact in minimally supported digital mental health interventions identified by participants was the lack of emotional connection. Even when guidance is available, it is often voluntary, and users can choose not to engage with the e-coach. Some participants described feelings of isolation. An important component of traditional therapy is the therapeutic alliance, which is defined as the collaborative bond between therapist and patient [40]. Despite feelings of isolation expressed by some participants, there is evidence that a positive therapeutic alliance can develop in fully automated digital mental health interventions [41]. Clarke et al. [41] found that the therapeutic alliance in a digital environment was not associated with treatment gains (in contrast to face-to-face psychotherapies), but that it was correlated with levels of engagement; perceived emotional engagement correlated positively with program use.

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5.5.3 *Facilitators and Barriers to Engagement*

Along with the convenience, flexibility, and anonymity of digital mental health interventions, participants in this study identified program content and design as a facilitator to engagement. They liked that the program was interactive and that it was presented well. Intrinsic motivation (finding the content interesting) has been shown to be an important factor in treatment adherence to digital health interventions [42], as is design and appearance [33,43,44]. If people like an intervention they are more likely to continue with it [44]. Design features appreciated by participants included estimation of time to complete each module, a progress tracker, and reminders to log in and use the intervention. There is evidence that reminders increase engagement with digital interventions [45-47] and that people who choose to receive reminders to log in and choose to receive motivational emails show greater symptom reduction [48]. There is also evidence, however, that these email prompts could be easily ignored (and even resented) in a workplace context as a consequence of a full inbox [49]. There was some evidence of this in this study, but almost half of the participants mentioned receiving and appreciating the Monday morning message; this suggests that when reminders have an additional value (ie, motivational quotes and well-being information and advice), they are more likely to stand out in a busy email inbox.

The role of the organization and line managers was identified as an important facilitator to engagement with the digital mental health intervention. It was important to many of the participants that their use of the intervention was confidential; stigma about mental illness was still something that was perceived as being prevalent in the workplace, with some participants saying that knowledge about their mental health problems could be career limiting. Research supports this perspective with evidence that the stigma associated with mental ill health can result in lower wages [50], underemployment, and precarious employment [51]. However, although participants did not necessarily want their employer to know that they were accessing the intervention, they did think that it was important for organizations and line managers to circulate information about the intervention and to encourage its use. Organizational support gave the intervention legitimacy and signaled to the employees that they could use it. By circulating this information, organizations would be showing explicit concern for employee well-being,

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which has been shown to result in higher levels of employee commitment to the organization [52]. Further research is needed to get a better understanding about the role of organizations in promoting take-up and engagement with occupational digital mental health interventions.

Participants identified the lack of time as the main barrier to engaging with digital mental health interventions in the workplace. The lack of time has been identified by other studies on digital health interventions delivered in the workplace as a reason given by participants for disengaging from interventions [53-56]. Future research could explore further the role of employers in helping employees to prioritize accessing digital mental health interventions in the workplace.

5.5.4 The Role of the E-Coach

The intervention used in this research provided minimal guided support from an e-coach. In line with other minimal guided interventions (see [57]), the e-coach provided adherence support (log-in reminders) and feedback on request. Interviewees were divided by their experience of the e-coach and by how proactive they wanted the coaching to be. This division suggests that the type of support people want is a personal preference and might be best negotiated with the individual at the start of the program.

5.5.5 The Perfect Web-Based Intervention

When describing their perfect digital mental health intervention, interviewees described a simple, interactive, and easy-to-navigate website that could be accessed via a computer or a smartphone. There are advantages to delivering interventions via mobile devices such as smartphones (e.g. the ability to employ ecological momentary assessments and to deliver interventions at moments of high need), but research in this area still remains in its infancy [45,58]. It was important to interviewees that the perfect intervention was anonymous and confidential and that it could be personalized (ie, tailored to their needs). Tailored interventions have been shown to be more effective than standardized approach to delivering digital interventions [59]. The intervention

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would combine a short course that users could work through independently with regularly updated, time-unlimited information and advice that they could dip in and out of over a longer period. The short course described by interviewees reflects features identified in a systematic review as increasing engagement with occupational digital mental health interventions [17]; these include providing guidance, delivering in a short time frame (6-7 weeks), tailoring, and self-monitoring. Regularly updated content has been identified as an inducement to revisiting digital interventions [43]. To our knowledge, no other study on digital mental health interventions has identified the desire to access time-unlimited information and advice.

Interviewees reported that they wanted support from an e-coach but were divided about whether the support should be asynchronistic or synchronistic. Digital interventions that provide human guidance have been shown to be superior to unguided interventions [24,47,60-63], but currently there is no research comparing asynchronistic guidance with synchronistic guidance in digital mental health interventions.

A number of interviewees suggested incorporating self-monitoring, including self-report of stress symptoms. Self-monitoring is a core feature of many behavioral and psychological therapies [64] and has been recommended as an important component in the delivery of digital mental health [45]. Interviewees were divided about the use of peer support with some people saying they would like it and others saying they would not use it. There is currently little evidence to support the use of online peer support groups for people experiencing depression [65,66] or for young people experiencing mental health problems [67].

5.5.6 Implications for the Workplace

The findings from this study suggest that the role of organizations and line managers is crucial to promoting the use of digital mental health interventions in the workplace. For some employees, digital mental health interventions were an important means of accessing convenient and flexible support, and it formed an important component of a broader health and well-being strategy. To encourage uptake and engagement with these

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interventions, organizations and line managers must actively promote the interventions, and while maintaining confidentiality, support the staff to prioritize time during working hours and identify a private space to access the intervention and to reflect on the content.

5.5.7 Limitations

One of the limitations identified in the original study was that the participants recruited to the study (predominantly well-educated women working in social care or the knowledge industry in senior manager or administrative roles) were not representative of the general workforce. This limitation is evident in this study. Moreover, the majority of participants recruited in this study reported that their work was predominantly office based and all participants described having some autonomy over their work schedule. It is highly likely that the facilitators and barriers to the use of digital mental health interventions among other working groups (e.g. employees working in blue-collar roles or in the service industries) will be different to those experienced by autonomous, office-based workers. There is a strong need for research into the use of occupational digital mental health interventions to be conducted in occupations and industries that are traditionally underrepresented (or wholly absent) in current studies.

Although this study was successful in engaging participants who did not perceive themselves as having engaged well with the intervention, participants were from a self-selecting group of employees who volunteered for the original trial and, therefore, did have some interest in engaging with digital mental health interventions. Therefore, we were unable to study the views of employees who may be less open to engaging with digital health interventions.

Another limitation to this study is the 1-year gap between participants being recruited to the original trial and being interviewed for this study. This meant that the study relied on participants' recollection of their experience, which may be flawed.

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5.5.8 *Conclusions*

Occupational digital mental health interventions have an important role in delivering health care support to employees in the workplace and should form part of a broader health and well-being package. For some people, digital mental health interventions delivered in the workplace may help them to access help, which they may not have done if they had to access face-to-face therapies or speak to their GP. The convenience, flexibility, and anonymity of digital mental health interventions was experienced as both positives and as negatives, helping people to engage with occupational digital mental health, but also acting as barriers to engagement. It is important that developers of digital interventions and employers work with employees to overcome these challenges.

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Abbreviations

CBT: cognitive behavioral therapy

GP: general practitioner

PSS: Perceived Stress Scale

RCT: randomized controlled trial

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Carolan, S., & de Visser, R. O. (2018). Organisational perspectives on purchasing digital mental health interventions for the workplace: A qualitative study. Manuscript submitted for publication.

6.1 Abstract

Background: The prevalence of common mental health disorders in the workplace is high, but many employers are unsure how to address these disorders. Even when occupational health support is provided, healthcare workers often have less knowledge about mental health problems than they do about physical health problems. One way to increase access to evidence based psychological interventions may be through the use of digital technology, but in the workplace, employers act as a gatekeeper to the interventions. If we really want to embed digital mental health interventions (DMHIs) into the workplace we need to have a greater understanding of the organisational and social context in which these interventions are being purchased.

Objective: The aim of this research was to get a better understanding of what decision makers in organisations see as the advantages and disadvantages of DMHI, and what their priorities are when making purchasing decisions.

Methods: Semi-structured interviews were held with 10 participants who influence or make purchasing decisions about wellbeing interventions for their organisation. Interview recordings were transcribed and anonymised prior to Thematic Analysis.

Results: The number one priority for organisations when choosing a DMHI was cost; this was followed by intervention efficacy which was described as psychological outcome, usage and satisfaction. It was important to participants that outcome data was

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relevant to the workplace, and that studies were conducted in a work context. The advantages of DMHIs were described as flexibility, convenience, confidentiality and reach. Within a work context, digital interventions had the potential to reach a broader group of employees. The disadvantages of DMHIs was a perception that it would be difficult to form a therapeutic alliance, and that they were not very engaging. Barriers to delivering DMHIs in the workplace were identified as employees' lack of access to equipment, and their low interest and low skills. There were some concerns about data security and confidentiality. Participants wanted DMHIs to be aimed at everyone, and to be accessible on smartphones and tablets. There was not a consensus about whether employees should use these interventions in their own time or in work time.

Conclusion: If we want to embed DMHIs in occupational settings we need a better understanding of how these interventions will be received and used and that knowledge needs to be embedded in the development process through co-design rather than introduced post development.

Key words

digital health, ehealth, employers, mental health, mhealth, occupational health, online, workplace

6.2 Background

The prevalence of common mental health disorders in the workplace is high with nearly one in three workers in Europe (Leka & Jain, 2010) and the United States (APA, 2010) reporting that they are affected by stress at work. But while prevalence rates are high, help seeking amongst the working population is low with one study reporting that only 15% of fulltime workers with a mental disorder had sought help in the preceding month (Lim, Sanderson & Andrews, 2000). Many employers especially small and medium sized employers are unsure how to address mental health problems in the workplace (Dewson et al., 2009), and even when occupational health support is provided, occupational healthcare workers often have less knowledge about mental health problems than they do about physical health problems (Lelliott et al., 2008). One way to increase workers' access to evidence based psychological interventions may be through

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the use of digital technology. There are a number of reported benefits to delivering health interventions digitally including the ability to deliver anonymous (Brouwer et al., 2011; Norman et al., 2007; Bennett & Glasgow, 2009), tailored interventions (Brouwer et al., 2011; Norman et al., 2007) that can have the potential to reach a large number of people at a lower cost compared with face-to-face interventions (Marcus, Nigg, Riebe, & Forsyth, 2000). A recent meta-analysis reported that occupational DMHIs can improve workers psychological wellbeing and increase work effectiveness (Carolan, Harris & Cavanagh, 2017). But, despite these perceived advantages and evidence of effectiveness there is little evidence that these interventions are being routinely offered by employers. If we want to address the unmet need amongst workers for evidence based psychological therapies by embedding DMHIs in workplaces, we need to have a greater understanding of how organisations make purchasing decisions. Organisations act as the gatekeeper to the delivery of these interventions in the workplace and as such it is essential that we understand the organisational and social context in which digital health is being purchased and delivered. There is a paucity of research in this area; a recent study explored the use of health apps in 12 of the largest companies in Germany, but they focused on app usage and not on how organisations select digital health interventions to make available to their workers (Steigner, Doarn, Schütte, Matusiewicz & Thielscher, 2017). The aim of this study was to begin to address this gap in the literature by exploring what decision makers in organisations see as the advantages and disadvantages to DMHIs, and what their priorities are when selecting interventions for their workforce. For the purpose of this study static web pages that provided access to psychoeducation and signposting to external resources were not identified as DMHIs. Interventions were coded as digital if technology was used to deliver the active element of the intervention, or if it was used as a medium for communication (e.g. video conferencing, e-counselling).

6.3 Methods

6.3.1 Recruitment

Nineteen UK-based organisations that expressed an interest in taking part in a randomised controlled trial (RCT) on occupational DMHIs (Carolan, Harris,

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Greenwood & Cavanagh, 2017) were invited to take part in this qualitative study. A personalised email was sent, with a follow-up email one week later. A further 813 individuals who had subscribed to a mailing list for an occupational DMHI (WorkGuru) were also invited to participate. For inclusion in this study participants had to be able to influence or make purchasing decisions about wellbeing interventions for their organisation. A participant information sheet and an informed consent form were sent to individuals who expressed an interest in the study. Informed consent was given in a recorded statement prior to the interview commencing. Ethical approval was granted by the host University's Ethics Committee.

6.3.2 Data collection

Ten individuals who met the inclusion criteria were interviewed. The first author conducted semi structured telephone interviews lasting 20-45 minutes over a two-week period in October 2017. The interview schedule consisted of exploratory open questions, such as "What would you look for when deciding whether to purchase a mental health programme that was delivered digitally?" Interview recordings were transcribed verbatim and anonymised.

6.3.3 Participants and their organisations

A description of participants and their organisations is given in Table 6.1. All participants worked in a health and wellbeing or a human resource capacity within an organisation. The number of employees employed by the organisations ranged from 30 to 15000. All the organisations had more than one base; one organisation had a small satellite base with just three workers, other organisations had multiple bases internationally, nationally or across one region.

Table 6.1: Description of participants

Name	Gender	Age	Type of organisation	Number of employees	Type of roles in organisation
Aileen	Female	42	University	2500	Knowledge workers
Anna	Female	35	Local government	4000	Knowledge workers and manual workers
Christine	Female	44	Telecommunication	240	Knowledge workers and technical staff
Diane	Female	57	University	5000	Knowledge workers
Elizabeth	Female	59	Third sector	1000	Carers
John	Male	42	Local government	4500	Knowledge workers, carers and manual workers
Karen	Female	52	Digital technology	15000	Engineers, knowledge workers, sales staff
Lesley	Female	63	NHS acute trust	3000	Manual and clinical workers
Sharon	Female	57	Engineering	30	Manual workers
Tina	Female	48	Local government	8500	Knowledge workers and manual workers

Note: Knowledge workers = Workers whose job requires them to handle or use information.

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6.3.4 Data analysis

Transcripts of interviews were analysed using Braun and Clarke's (2006) six-phase guide to Thematic Analysis: 1) familiarise yourself with the data (including reading and re-reading the data), 2) generate initial codes (coding interesting features across the entire data set), 3) search for themes (collating codes into potential themes), 4) review themes, 5) define and name themes and, 6) produce the report. They describe the analysis as a recursive process rather than a linear one. Both authors independently reviewed a subset of the transcripts and then worked together to construct and negotiate a shared meaning. The first author coded the remaining transcripts, which were reviewed by the second author for any inconsistencies.

6.4 Results

The analysis identified six major themes. Each of these is described below and illustrated with quotations.

6.4.1 Stress in the workplace and current provision

Participants recognised the impact that stress had on their workplace. For example, Anna described stress as “our main reason for sickness” and “the main reason for absence from work”. Sharon described how a number of her staff had experienced problems with their mental health and how the problems that they experienced were not just from work related stressors:

Quite a few of the lads that work with us have issues. We have some lads with defined mental health problems, and we have other lads that they have things in their life, if their partner leaves, or falls out with their partners. (Sharon)

John recognised the impact that the workplace could have on people's health but also the role the workplace could have in providing treatment and support, “The workplace offers opportunities for people's health, but the workplace is also a cause of people's ill health”.

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Nearly all participants reported that their organisations were currently providing their staff with access to Occupational Health and an Employee Assistant Programme (EAPs provide access to information, support and counselling for staff), which for most organisations included face-to-face or telephone counselling. Most interviewees said that external organisations provided these services. Almost all participants reported that staff had access to web pages that contained psychoeducation and signposting to relevant websites and services. Fewer than half of the interviewees said that their organisation provided mental health training: two of those participants said that the training was aimed at line managers to help them support staff who may be experiencing mental distress. Two participants reported that their organisations were already providing digital health services to their employees: the first provided direct messaging counselling through their EAP; the second organisation provided email access to a medical doctor. Not all of the participants had a clear understanding of what a digital intervention might look like, or how it could be delivered, and were often unclear about the difference between psychoeducation provided on a static webpage and a DMHI.

6.4.2 Priorities when choosing an occupational DMHI

When identifying the number one priority when considering purchasing an occupational DMHI for their organisation most participants identified the cost of the intervention, this was followed by intervention effectiveness. When asked about priorities for decision making, John said “It goes without saying, for us it would be cost”. Anna reported that despite cuts to their funding, the wellbeing of their workforce was still a priority, although cost of the intervention remained an important consideration:

In spite of [cuts to funding] and money being limited, we are committed to having a healthy and happy workforce, so we would be prepared to put some investment in there. But we haven't got bags and bags of money to do that.

(Anna)

Karen reported that “cost is just as much an issue for the private sector as the public sector” and that within her private sector organisation not a lot of money was being spent on wellbeing, even though she and others thought that it should be:

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Things are on a shoestring, because every penny is being accounted for. So, there's never lots of money being thrown at wellbeing, unfortunately. (Karen)

Evidence for the effectiveness of a DMHI was a key priority for participants, but effectiveness was described in different ways. For some people, it was psychological or behavioural outcome data: they wanted to see a reduction in sickness absence and levels of stress and an increase in engagement with the organisation (e.g., increasing the extent to which employees feel a positive orientation towards the organisation and to their work). For others, effectiveness was measured by usage and satisfaction data. Elizabeth suggested that efficacy data would be useful, but usage and satisfaction data would be even more important:

It would be good to have some sort of idea of efficacy of the tool in itself but that wouldn't be as important as then seeing how many people wanted to use it and whether they found it useful. (Elizabeth)

It was important to participants that any outcome data were relevant to the workplace. One example given was that just because someone was increasing their physical exercise, it did not mean that this was a reflection of their happiness at work:

Just because somebody is doing marathons every weekend, doesn't necessarily mean that they're happy at work. Do you know what I mean? I'd need to have some sort of correlation. (Aileen)

For John, it was not only important that outcome data were work-specific, it was also important that such data were gathered within the context of the workplace:

The workplace is quite specific. It's not about whether mindfulness works. It's about, "Does delivering mindfulness halfway through someone's day - in a workplace - result in a change in behaviour?" (John)

Some participants said that they would look for clinical trial data to inform their decision, and others said that they would want to see positive recommendations or quotations from other organisations as evidence of the interventions effectiveness:

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It would be more important maybe to see quotes of what other people have said or what other employers have thought. (Elizabeth)

A number of participants suggested that they would want to see return on investment (ROI) data to show that if their organisation invested in DMHIs they could see a cost saving on absenteeism and productivity to their organisation:

Invest to save basically. Would I be able to put a justifiable argument that if we invested in this, at the other end our savings might be X, Y and Z? (Lesley)

6.4.3 Advantages of DMHIs

Participants identified the flexibility and convenience of DMHIs as being two of the advantages. Karen described these advantages as “You can do it anywhere, anytime, to suit, and the ease. It’s just so easy, isn’t it?” Anna described these advantages as being able to access the interventions at a time and place that is convenient to the user and without having to wait for an appointment:

They’re accessible at all times so staff so they don’t have to do it in the workplace if they don’t want to. They can do it on their smartphones. They can do it outside of working hours, over the weekend, and it’s something that they can access readily, so they don’t have to wait to see a counsellor for three days. They can access it immediately. (Anna)

The anonymity of the Internet was also described as an advantage of DMHIs, especially given the stigmatisation of mental illness. Interviewees appreciated that employees could access a digital health intervention without their colleagues or line manager knowing about it:

Anything online creates that environment where people can easily access it without it being known about - and fear of what that might mean or the repercussions of that. (John)

Another advantage of DMHIs identified by participants was that it allowed organisations to reach a broader group of employees than could be reached by face-to-

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face interventions. Diane described it as being able to access “a different part of your community who may not be accessible otherwise”. Christine suggested, “If it was on a smartphone, it’s totally different and you would be hitting a totally different audience with it, a wider audience, definitely”. One reason for this increased reach was that DMHIs allowed organisations to offer support to employees regardless of where geographically in the organisation they were working:

It is available whenever people want it, wherever they want to use it and we’ve got hundreds of work sites, we can’t possibly get out to onsite visits for every workplace to give equal access to things. (Tina)

As well as providing an advantage to organisations with multiple bases, it was observed that digital health interventions were also convenient for staff working shift patterns who may not be able to attend face-to-face interventions during office hours. When talking about the role of carers in her organisation, Elizabeth said “a digital solution would suit them because they work shift patterns”.

Some of the employers interviewed for this study felt that by purchasing DMHIs they would show that they are being inclusive, “you would show that you are making it available to everyone” (Tina). Purchasing these interventions for employee use also showed their employees that they cared and that they thought good mental health was important:

It’s an initiative which you can promote which flags up to your colleagues, your employees within your organisation that the organisation does care about their health and wellbeing. (Diane)

Interviewees also expressed a belief that by providing digital health interventions, organisations were showing their employees that they valued them:

It’s knowing that you’ve got the resources there if you wanted to use them, that they are provided for you and you’ve been valued enough to have them provided for you. (Elizabeth)

6.4.4 Disadvantages of DMHIs

Participants identified two main disadvantages to DMHIs: (a) that it was more difficult than face-to-face interventions to form a therapeutic alliance, and (b) that they were not very engaging. Karen suggested that face-to-face interventions were more effective in showing users empathy and support, “Sometimes you can’t beat the face-to-face, and somebody being there in person to empathise and support”. John described how his organisation’s experience of online learning suggests that digital interventions may not be very engaging, “I think, certainly, what we’re seeing with our online learning is that it isn’t always engaged with”. In addition, Diane described one of the disadvantages as it being easy to forget about, “It’s easy to forget about it, it’s easy not to do. I suppose that’s the disadvantage”.

6.4.5 Barriers to delivering DMHIs in the workplace

Interviewees identified a number of barriers to delivering DMHIs in the workplace. These were employees’ lack of access to equipment, low interest and low skills, and concerns about data security and confidentiality.

Participants talked about how some of their staff didn’t have access to the necessary equipment to use DMHIs. For example, Lesley described how not everyone in her organisation had access to smartphones and computers:

We take it as read that everybody’s got smartphones and computers, but actually we’ve still got people that are in poverty, particularly if you’re looking at public sector workers who might not have access to those things. (Lesley)

However, even when staff do have access to the appropriate equipment, interviewees described a lack of interest shown by some staff in engaging digitally with their organisations. Aileen described how staff were not accessing the organisation’s intranet or engaging with the EAP digitally:

The staff have difficulty even accessing our intranet, and are complaining about the number of emails that they’re getting, and they’re barely interacting with our EAP. When they interact with our EAP, it’s mainly over the phone rather than online. (Aileen)

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A number of participants described the process of their organisation moving to a digital payroll system as an example of how their staff were showing low interest in engaging digitally. Despite supporting some of their staff to get email addresses so that they could log onto the system, staff were still not accessing their digital payslips. For Aileen, the reluctance of some employees to engage digitally suggested that the organisation should not be investing in digital interventions, “There's not much point in us going down the digital intervention route any further”. For Elizabeth, it suggested that the organisation needed to work with those staff to develop their skills and confidence:

If we were looking for a solution, we may have to then do some extra work ourselves to be able to support some of our staff to be able to access a benefit that we rolled out to everybody else. (Elizabeth)

One reason that employees may be reluctant to engage digitally may be low skills. Examples given by interviewees included older people, and people working in carer roles or manual labourer roles who had low information technology (IT) skills. Diane estimated that about 20% of the staff in her organisation are not digitally confident, Elizabeth estimated a similar level at about 10 – 15% in her organisation. As well as low IT literacy and confidence, some interviewees saw low reading literacy levels amongst their workforce as a barrier to delivering DMHIs. Anna described how some of her staff (described as ‘officers’) have literacy problems, “We have some officers who have got literacy and numeracy problems. They can’t read or write”, and Sharon described how some of her staff have few or no educational qualifications, “The people here are generally just ordinary people with little or few qualifications, or none at all”. The suggestion made by participants was that low literacy could impact on people’s ability to engage with digital interventions

Some participants identified concerns about data security as a barrier to accessing DMHIs. Karen described it as a lack of trust:

There is that lack of trust, not in the company; just generally people don’t like that sort of thing. [...] people are never sure who’s looking at the data, even

though we do say, “It’s strictly confidential,” there’s a lack of trust there.

(Karen)

Other participants said that they would presume that if an intervention was being made available, then the organisation would have the necessary governance procedures in place. Concerns about data security were expressed by some participants as concerns about confidentiality. Anna suggested that employees might be concerned about the stigma about mental health and their organisation knowing that they were accessing mental health treatment:

“Staff are suspicious. I don’t know whether they see accessing something like this as a weakness or something that the organisation is going to hold against them.”

One of the consequences of staff not engaging digitally with their organisation was the risk of missing out on important information and services. Participants observed that a lot of information is now disseminated digitally in organisations which results in staff that do not have access to digital devices or the Internet getting missed out:

A lot of the things that we run these days are digital and we send things out by e-mail, [...] And they’re a whole group of staff that tend to get missed really.

(Anna)

6.4.6 Delivering DMHIs in the workplace

Interviewees described how a DMHI would be used in the workplace. The majority of participants said that their organisations would want to offer a universal intervention that was aimed at everyone in the organisation, rather than an intervention that was only aimed at people who were known to be experiencing depression, anxiety or stress:

“I think we’d probably make it available to everybody, because you never know, some people don’t flag things up, they’re suffering in silence” (Karen).

Participants expressed a preference for the intervention to be accessible on smartphones and tablets. It was felt that desktop computers were less convenient:

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“Yes, I think it’d would be a smartphone. It would be more... yes, it’s easier to use, I think. Well, not easier to use, easier to access than your computer”

(Karen)

Others noted that people were using computers less than in the past:

I think it would need to be accessible on a range of things because, yes, smartphones, everyone has a smartphone. iPads, tablets, that’s the next thing. I think computers generally are moving away now. (Sharon)

In addition, it was suggested that computers may be less confidential if people had to access the intervention through a company email or IT system which could then be tracked by the employer:

I think people would take to it more if it was a smartphone app, because it’s not actually going through a company computer and they can use their own email address on it. I think that would be easier for them to take that route than logging on via a company. (Christine)

There was no consensus about whether interviewees would expect employees to access the intervention in their own time, in work time or both. Elizabeth explained how her organisation is commissioned to provide a set amount of client contact time by staff who worked as carers, and that this did not leave enough additional work hours for the staff to receive the necessary support and training, so there would not be enough hours in the working week for staff to access the intervention in work time:

For some of our staff it would have to be in their own hours because they’re with clients. [...] Some of our staff don’t actually have a lot of work free time [...] Ideally, it would be in their breaks or in their unpaid time. (Elizabeth)

Several participants said that they would want their current EAP or Occupational Health provider to incorporate digital health into their service as this would offer value for money and consistency. However, Elizabeth suggested that although this might be the ideal, it could cause problems if organisations decided to change provider and staff were using the intervention:

I guess ideally, it'd be great if it was integrated but I can see also the advantage of having a standalone product because it wouldn't necessarily be impacted by changing. (Elizabeth)

6.5 Discussion

6.5.1 Stress in the workplace and current provision

Participants in this study recognised the prevalence of stress in the workplace and the impact that it had on individuals and on organisations. Nearly all of the organisations were providing some form of (non-digital) psychological intervention through occupational health or an EAP, but only two out of the ten interviewees reported that their organisation was providing a digital health service to their employees. Both of the services were using technology as a medium for communication and not to deliver an active component of a psychological intervention suggesting that the full potential of DMHIs has yet to be realised in the workplace. The low usage of digital health interventions within organisations reflects the findings of a study on the usage of health apps in 12 of the 20 biggest companies in Germany. The study authors reported that only three of the organisations were using digital health interventions (Steigner et al., 2017).

6.5.2 Priorities when choosing an occupational DMHI

The number one priority identified by interviewees when considering the purchase of a DMHI for their organisation was cost; it was essential that interventions were cost effective and affordable for organisations. This was closely followed by effectiveness. It was important to participants that outcome data was both relevant to the workplace (e.g. absenteeism, productivity, work engagement), and that it had been gathered within a work environment and not a health or community environment. It was also important that it incorporated both usage and satisfaction metrics. A recent systematic review and meta-analysis of digital occupational health interventions by Carolan, Harris and Cavanagh (2017) found that only a small number of studies reported occupational

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outcomes, the majority of studies conducted in the workplace only reported psychological outcomes (e.g. depression, stress and anxiety).

Participants reported that they would want to see ROI data so that they could show that by investing in DMHIs they could make savings to the organisation. High quality trial based economic evaluations are important to help decision makers make informed decisions about purchasing occupational health interventions (van Dongen et al., 2014). With a few notable exceptions (see Ebert et al., 2017) occupational digital mental health research focuses on clinical evidence in terms of health outcomes and doesn't focus on broader factors such as ROI and workplace outcomes which are needed to help organisations make purchasing decisions. This is similar to difficulties encountered with the dissemination of digital health technologies in health care settings (van Limburg et al., 2011).

Establishing the efficacy of interventions was important to participants in this study, but they were divided about whether they wanted to see evidence for efficacy in a clinic trial or through more informal feedback from other organisations. A recent study on evidence-based practice in organisations reported that the majority of managers base their decision making on personal experience (91%) and intuition (64%) rather than scientific research (27%). Barriers to engaging with scientific research were identified as lack of time and limited understanding (Barends et al., 2017). To encourage organisations to adopt evidence-based practice it is important that researchers on occupational DMHIs ensure that their research is relevant to organisations, that it reflects their concerns and priorities, that it is presented in a way that engages non-academics, and that it is disseminated through channels used by managers and occupational health professionals.

6.5.3 Advantages of DMHIs

Participants in this study identified flexibility, convenience and anonymity as advantages to DMHIs. These are the same advantages that were identified by employee participants in a qualitative review of barriers and facilitators to engaging with DMHIs

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in the workplace (Carolan & de Visser, 2018). In this present study, reach was also identified as an advantage to DMHIs; within a work setting digital interventions enabled organisations to provide a service to employees regardless of where they were physically based or the hours that they worked. It was also suggested that digital interventions could expand the reach of psychological interventions by appealing to a broader group of employees who may not wish to use face-to-face interventions. Researchers have also cited increased reach as an advantage to digital health, but research does not provide evidence for this. A number of reviews on digital health have concluded that the actual reach of these interventions are undiversified, predominantly engaging middle-aged white women (Kohl, Crutzen & de Vries, 2013; Lui, Marcus & Barry, 2017). It is possible that a broader demographic are using digital health interventions but that they are under-represented in clinical trials; even so, evidence is limited and more research is needed to fully understand and utilise the potential of occupational DMHIs to reach a broader more diversified group of people.

6.5.4 Disadvantages of DMHIs

Participants identified difficulties in forming a therapeutic alliance and maintaining engagement as disadvantages of DMHIs. Some participants felt that face-to-face therapies made it easier to empathise and support individuals. Research would not support this presumption. The term therapeutic alliance is used to describe the collaborative bond between therapist and patient; it has been identified as having a significant effect on therapeutic outcome (Krupnick et al., 1996). Research suggests that DMHIs have an equivalence with face-to-face therapy in terms of therapeutic alliance (Sucala et al., 2012) and it has been found that it is possible to form a positive therapeutic alliance even with fully automated DMHIs (Clarke et al., 2016).

One of the challenges of DMHIs has been identified by researchers as increasing engagement and adherence (Cavanagh and Millings, 2013; Eysenbach, 2005; Kohl et al., 2013), but recent trials of occupational DMHIs are achieving good adherence (Ebert et al., 2016; Heber, Lehr, Ebert, Berking & Riper, 2016; Thiart, Lehr, Ebert, Berking & Riper, 2015; Zarski et al., 2016) which is suggesting that more modern interventions

may be overcoming some of the problems with engagement that were being experienced by older interventions.

6.5.5 Barriers to delivering digital health interventions in the workplace

Participants described the lack of access to the necessary equipment as a barrier to delivering DMHIs in the workplace. Despite high rates of Internet penetration in some parts of the world (In 2017, 95% of the population had access to the Internet in the UK, with 85% in Europe and 95% in North America (www.internetworldstats.com), Internet penetration is lower in Africa (35%), Asia (48%) and Latin America (67%)), it is likely that fewer people will have the convenient and private access to a smartphone, tablet or computer that is necessary to engage with a DMHI. But, this is changing. In the UK 85% of people now own or have access to a smartphone with the adoption by 55 to 75 year olds now reaching 71% (Deloitte, 2017), and it is likely that the newer occupational DMHIs that are being developed will be optimised for smartphone use. This trend towards greater smartphone ownership and the increased availability of interventions accessible on them will lead to a decrease in the relevancy of this barrier. However, it is important that employers recognise that not all staff will have access to the necessary equipment to access these interventions.

Another barrier described by interviewees was workers' low interest in engaging digitally with their organisation, and their low skills. A survey of adult skills across 33 countries reported that 19% of adults have poor reading skills and one in four adults have no or limited experience with computers (Organisation for Economic Co-operation and Development, 2016). People with low literacy and numeracy skills are less likely to search for health information online and are less likely to use digital health technology (Jensen, King, Davis & Guntzviler, 2010; Kutner, Greenberg, Jin & Paulsen, 2006), which suggests that there may be a link between low skills and low interest in engaging digitally. There are ways to overcome this; there is evidence that people with limited literacy and technology skills can successfully use well designed digital health interventions (Miller et al., 2017), but the usability of many digital health apps is

suboptimal creating a gap between the potential and the reality of digital technology for diverse populations with chronic conditions (Sarkar et al., 2016).

The final barrier identified by participants was data security and confidentiality concerns. Participants were divided about the extent that they thought employees would be concerned about data security. Some thought it would be a concern and others thought that it would not. A review of health app use reported that confidence about data security was high among mobile phone users who had downloaded apps, but it was low amongst users who had not downloaded apps (Krebs & Duncan, 2015) suggesting that concerns about data security was a barrier to digital health intervention use for some people. Within a workplace setting there are concerns about confidentiality and the perceived negative impact of an employer or work colleague knowing that an individual was accessing a DMHI. Stigma about mental illness remains a concern amongst employees and a potential barrier to the use of occupational DMHIs (Carolan & de Visser, 2018).

6.5.6 Delivering DMHIs in the workplace

Participants were evenly split between whether they would want participants to access a DMHI in their own time or in work time. A recent study of employees' perspectives on occupational DMHIs reported that all participants in the study accessed the intervention during working hours - including their lunch breaks (Carolan & de Visser, 2018). Participants in that study were predominantly office-based workers, the intervention that was used was accessed via a web browser and it was not fully mobile phone enabled. It is possible that participants may choose to access a digital health intervention differently if it was accessible on a mobile phone, or if the user was not office based. The ease of access to the intervention may influence the way that users choose to engage with it.

6.5.7 *Limitations*

The participants that took part in this study were employed by a broad range of employers including employers of different sizes, different sectors and employing a different workforce. It is possible that more consensus on the priorities when purchasing DMHIs could be found by sub dividing analysis into more similar groups.

6.5.8 *Implications*

The findings from this study suggest that if we want to increase the adoption, deployment and diffusion of DMHIs into organisations then all stakeholders need to work together to get a better understanding of how these interventions will be used and received in occupational settings; intervention designers, digital health researchers, employers and workers all have a role to play. Planning for the successful implementation of these interventions should be incorporated into the design through a co-design process; designers and developers working with employers and workers including workers with low IT and literacy skills to co-design interventions and ensure that they maximise their utility, effectiveness and appeal. Designers should ensure transparency about data use and security, including what information is made available to employers. Researchers should ensure that they conduct studies in occupational settings with occupational groups and incorporate outcome data that are relevant to employers including economic evaluations. They should also ensure that the results of their research are made accessible and available to non-academic audiences including managers and occupational health staff. Employers should work with their staff to increase IT confidence and to find ways of increasing access to the necessary equipment to enable their staff to fully take part in the digital services and the opportunities that they offer.

6.5.9 *Conclusion*

This study identified cost and effectiveness as the priorities for decision makers when deciding whether to purchase a DMHI for their employees. The advantages of

occupational DMHIs were identified as flexibility, convenience, confidentiality and reach, and the disadvantages were perceived difficulties in forming a therapeutic alliance and keeping users engaged. Barriers to delivering these interventions in the workplace were identified as employees' lack of access to equipment, low interest, and low skills. Employers wanted a universal digital intervention that could be accessed by workers on a smartphone or tablet. If we want to embed DMHIs in occupational settings we need a greater understanding of the way that these technologies will be received and used, and that knowledge needs to be embedded in the development process through co-design rather than introduced post development. Working with employers and workers to develop these interventions will help ensure that they meet the needs of both the organisation and the workforce and that we can maximise access and take-up of evidence based digital psychological interventions in the workplace.

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7 Discussion

The four studies presented in this thesis were designed to address the research aim of increasing understanding of how digital mental health interventions are delivered and received in the workplace, and to provide an overview of what more can be done to help employees engage more effectively with these interventions. This final chapter provides a summary of each of the studies' findings in the context of the research aims. It then explores the implications of these findings and presents recommendations aimed at intervention developers, employers and users to help increase adherence to occupational digital mental health interventions. It also makes recommendations aimed at developers and researchers to increase employer uptake of these interventions; and it compares other theoretical frameworks of engagement with digital health interventions with the recommendations presented here. I then reflect on some of the findings that emerged from the research. Finally, the chapter presents some of the limitations of the research programme, and the conclusion provides a summary of the overall findings.

7.1 Summary of findings

7.1.1 Systematic review and meta-analysis of digital mental health interventions delivered in the workplace (Chapter 3)

A systematic review identified 21 RCTs that met our search criteria. A meta-analysis indicated that digital mental health interventions delivered in the workplace produced a small positive effect on psychological wellbeing and a small positive effect on work effectiveness. These findings suggest that occupational digital mental health interventions are as effective at improving mental health outcomes as other more traditional, non-digital occupational health programmes, and other digital health interventions delivered in non-occupational settings. Further analysis of the included studies suggest that within an occupational setting, interventions that achieved the greatest adherence were those that offered guidance, were delivered over a shorter time frame (6 to 7 weeks), utilised secondary modalities for delivering the interventions and engaging users (i.e. email and text messages), and used persuasive technology (i.e. self-

monitoring and tailoring). App technology was identified as a promising modality for engaging users of occupational digital mental health interventions.

7.1.2 Increasing engagement with an occupational digital stress management intervention: Pilot RCT (Chapter 4 and published protocol Appendix 1)

In the pilot RCT, 84 individuals from six organisations were recruited to this study and randomised to one of two active conditions (access to a minimally-supported CBT based stress management intervention with (DG) and without (MSG) access to an online facilitated discussion group), and a wait-list control condition. A greater number of logins was observed for the DG compared with the MSG suggesting that access to the online facilitated discussion group increased exposure to the stress management intervention, but this didn't necessarily result in improved psychological outcomes or increased satisfaction when compared to access to the intervention without the discussion group. Delays in recruiting to the discussion group resulted in the groups running below their optimum size of 30, this may have affected both the satisfaction with the groups, and their effectiveness in optimising engagement. Because of these problems with the study design, we suggested that our finding that participants accessing the intervention without a discussion group benefited most from the intervention be interpreted with caution.

7.1.3 A qualitative study of employees' perspectives on engaging with digital mental health interventions in the workplace (Chapter 5)

Semi structured interview were held with 18 participants from the RCT, and thematic analysis was used to identify important aspects of user experiences. Participants described digital mental health interventions as convenient, flexible and anonymous, but in a workplace setting these attributes could be experienced as both facilitators and barriers to engagement. As well as increasing opportunities to engage with these interventions, in a workplace setting convenience and flexibility could also result in difficulty in prioritising time and ensuring a temporal and spatial separation between work and therapy. The anonymity of the Internet enabled participants to access help

without fear of stigma, but the advantage could be lost in an open office environment. Not having to speak to anyone gave some participants the confidence to access the intervention, which they may not have done if they had to attend a face-to-face appointment or speak to their GP, but it also meant that some participants felt that the lack of face-to-face contact made it easier to disengage from the intervention. Other facilitators to engagement included interesting and interactive content and design features such as progress trackers and reminders to login. The role of the organisation and line managers in encouraging the use of digital mental health interventions and circulating information about them was identified as an important facilitator to engagement with digital mental health interventions: support by the employer gave the use of these interventions legitimacy. The main barrier to engagement with digital mental health interventions in the workplace was lack of time. Interviewees were divided by their experience of the e-coach and by how proactive they wanted the coach to be, suggesting that the type of support people want is idiosyncratic and might be best negotiated with the individual at the start of the program.

7.1.4 A qualitative study of organisational perspectives on purchasing digital mental health interventions for the workplace (Chapter 6)

Employers act as gatekeepers to digital mental health interventions that are delivered in the workplace. If we want to increase the adoption, deployment and diffusion of these interventions then we need a greater understanding of the organisational and social context in which these interventions are being purchased. To this end, 10 participants who influence or make purchasing decisions about wellbeing interventions were interviewed. The number one priority for organisations when choosing a digital mental health intervention was cost; this was followed by intervention efficacy, which was described as psychological outcome, usage and satisfaction. It was important to participants that outcome data were relevant to the workplace, that studies were conducted in a work context, that they reflected organisations' concerns and priorities, and that results were disseminated to non-academic audiences. The advantages of digital mental health interventions were described as flexibility, convenience, confidentiality and reach. Within a work context, digital interventions had the potential to reach a broader group of employees, regardless of where they were physically based

or the hours that they worked. The disadvantages of digital mental health interventions were a perception that it would be difficult to form a therapeutic alliance, and that they were not very engaging. Key barriers to delivering digital mental health interventions in the workplace were employees' lack of access to equipment, and their low interest and low skills. There were also some concerns about data security and confidentiality. Participants wanted digital mental health interventions to be aimed at everyone, and to be accessible on smartphones and tablets. There was not a consensus about whether employers expected employees to use these interventions in their own time or in work time; expectations of when these interventions would be used need to be clarified with each organisation and communicated to employees.

7.2 Implications

Research on the use of digital mental health interventions delivered in an occupational context is scarce (Dunkl & Jiménez, 2017; Lehr et al., 2016). The research conducted for this thesis suggests that these interventions are an effective means for delivering mental health treatment in the workplace. This research also supports the finding that digital mental health interventions can provide support and treatment options for people who may not want to speak to their GP, or attend a face-to-face treatment. The benefits of digital mental health interventions are clear; this research shows that users value their convenience, flexibility and anonymity, and employers value their potential to expand the reach of mental health treatment by enabling organisations to provide mental health treatment to employees regardless of the hours that they worked or where they were physically based. But despite the benefits of these interventions, researchers continue to express concern about poor adherence and engagement (Bennett & Glasgow, 2009; Brouwer et al., 2010; Cavanagh & Millings, 2013; Eysenbach, 2005; Kelders, Kok, Ossebaard & Van Gemert-Pijnen 2012; Kohl, Crutzen, & de Vries, 2013; Waller & Gilbody, 2009).

Furthermore, this research suggests that despite the growing number of mental health apps and websites that are currently available, digital health is still an underdeveloped resource. Only four of the 18 employees interviewed for the qualitative study of employees' perspectives on engagement and adherence (Chapter 5) had previous

experience of using a digital health intervention, and only two of the 10 interviewees in the qualitative study of employers' perspectives on purchasing these interventions (Chapter 6) reported that their organisation was providing some form of digital health intervention for their employees.

The research reported in this thesis focused on digital mental health interventions delivered in an occupational setting, it makes a number of recommendations aimed at digital mental health intervention developers, employers and intervention users to help increase adherence to these interventions (see Table 7.1) these are discussed below. As well as making recommendations for increasing adherence to these interventions, this research also looked at the role of employers in purchasing digital health interventions and making the interventions available to their employees. This research argues that for employees to adhere to or engage with digital mental health interventions, then these interventions need to be made available to them; and if we want to increase the adoption, deployment and diffusion of these interventions in the workplace then we need to ensure that these interventions address the needs of employers and organisations. Recommendations for increasing uptake of these interventions by employers are given in Table 7.2 and discussed below.

7.2.1 Recommendations for improving adherence

This research has identified a number of actions that could be taken by intervention developers, employers and intervention users to improve adherence to occupational digital mental health interventions. These recommendations are presented in Table 7.1.

Table 7.1: Recommendations for improving adherence to occupational digital mental health interventions

Developers	<ul style="list-style-type: none"> • Develop interactive content that is simple to follow, easy to navigate, interesting and attractive. • Utilise design features including tailoring, self-monitoring, progress trackers, and login reminders that include added value features (i.e. wellbeing advice and motivational quotations). • Increase relevancy to workers by ensuring that content reflects the workplace setting and incorporates relevant theoretical frameworks of occupational stress. • Make the interventions accessible on a mobile device (e.g. smart phones, tablet, wearable devices). • Enable users to be engaged in different ways including email and text messages. • Provide e-coaching support that can be tailored to the user.
Employers	<ul style="list-style-type: none"> • Address stigma about mental illness in the workplace. • Support staff to develop IT, literacy and numeracy skills. • Work with employees to increase access to digital equipment and to provide private spaces to access digital mental health interventions. • Circulate information about digital mental health interventions and encourage their use.
Users	<ul style="list-style-type: none"> • Set intention and prioritise time to use digital mental health interventions.

Developers

The first recommendation made to developers to help improve adherence to occupational digital mental health interventions is to develop content that is simple to follow, easy to navigate, interesting and attractive. Other researchers have also emphasised the importance of interventions to be “desirable, compelling and delightful” (Ludden, van Rompay, Kelders & van Gemert-Pijnen, 2015); Ludden et al. (2015) suggested that well designed digital health interventions may not only increase adherence but could also increase positive effect by triggering positive emotions.

The second recommendation for developers is that they incorporate design features including tailoring, self-monitoring, progress trackers and login reminders. Tailoring (providing information relevant to the individual) and self-monitoring (tools to allow users to monitor themselves) have been identified in other studies as features that encourage adherence (Tailoring: Bakker, Kazantzis, Rickwood & Rickard, 2016; Brouwer et al 2009; Christensen, 2014. Self-monitoring: Bakker et al., 2016). One of the advantages of incorporating self-monitoring on mobile technology identified by Bakker et al. 2016, is that smartphones are capable of ecological momentary assessment which negates the problem of recall bias which is found in other forms of self-monitoring.

Research has identified the importance of incorporating elements of persuasive design in digital health interventions. In a systematic review of intervention characteristics and persuasive design which affect adherence to digital health interventions, Kelders et al. (2012), reported that better adherence was predicted by increased guidance, more frequent intended usage, more frequent updates, and extensive employment of reminders to login. Other studies have also supported the importance of login reminders (Bakker et al., 2016; Brouwer et al., 2008; Donkin & Glozier, 2012; Fry & Neff, 2009). In this programme of research, the qualitative study of employees’ perspectives on engagement (Chapter 5) identified login reminders as a feature that encouraged engagement, but there was also evidence that login prompts that had an additional value (i.e. motivational quotes and wellbeing information and advice) were appreciated more and stood out more in a busy inbox compared with automated reminders.

The third recommendation made to developers to increase adherence to digital mental health interventions, is to increase the relevance of these interventions to workers by ensuring that the content reflects the workplace setting and incorporates relevant theoretical frameworks of occupational stress. Increasing the relevance of digital health interventions to users has been suggested as an effective measure for increasing adherence by other researchers (Alfonsson, Olsson & Hursti, 2016; Brouwer et al., 2008. Ludden et al., 2015). One way to increase the relevance of an intervention aimed at workers may be through incorporating relevant theoretical models of occupational stress (for an overview of these models, see section 1.3). As well as increasing the relevance of these interventions to workers, incorporating these models of occupational stress may make digital mental health interventions delivered in occupational settings more effective (Lehr et al., 2016).

The fourth recommendation made to developers is to utilise mobile technology. The added advantages of mobile devices over desktop computers are their convenience and portability, and their ability to deliver ecological momentary interventions (EMIs). EMIs describe the delivery of personalised interventions in the context of people's daily lives (Schueller, Aguilera & Mohr, 2017). Mobile devices can also utilise sensor technology, which is embedded in these devices. Sensors can passively gather data on (amongst other things) location, communication, movement, light, sound, social media use, and proximity to other mobile devices. This information can be used for diagnosis of mental health problems, the delivery of EMIs, and the evaluation of interventions. The development and evaluation of interventions using personal sensing data are in the very early stages but the potential benefits for utilising this data are enormous and game-changing (Mohr, Zhang & Schueller, 2017c).

The fifth recommendation for developers is to enable users to be contacted in different ways including by email and text messages. Results from the meta-analysis reported in this thesis (Chapter 3) suggest that interventions that achieve the greatest level of adherence use secondary modalities for delivering the intervention and engaging users. Brouwer et al., (2011) also reported the importance of email and phone contact with users.

The last recommendation made to developers to improve adherence to digital health interventions is to provide e-coaching support that can be tailored to the user. Research consistently shows that providing guidance can lead to greater adherence to digital interventions (Andersson & Cuijpers, 2009; Brouwer et al., 2011; Heber et al., 2017; Hilvert-Bruce, Rossouw, Wong, Sunderland & Andrews, 2012; Mohr, Cuijpers & Lehman, 2011; Richards & Richardson, 2012; Zarski et al., 2016), but the challenge is how to provide that support without increasing cost or reducing reach (e.g. providing support in the form of phone calls or face-to-face meetings will limit the convenience and flexibility of the intervention). In the qualitative analysis of employees' experiences (Chapter 5) there was no consensus about the amount of support that participants wanted from the coach. Some participants could not see the value of the support, and other participants wanted pro-active support. One way to address this ambivalence is to tailor coaching support to the preference and need of the individual user.

Employers

The first recommendation made to employers to increase adherence to digital mental health interventions is to address the stigma about mental illness in the workplace. Participants in the qualitative study on employees' experience of engaging with occupational digital mental health interventions identified stigma of mental illness as a prevalent issue in the workplace. As previously stated (Sections 1.6 & 1.7), the stigma and lack of understanding about people who experience poor mental health that is prevalent in society is also high amongst employers (Staniland, 2011), it has been shown to impede help seeking amongst people who experience mental health problems (Clement, et al., 2014; Corrigan, Druss & Perlick, 2014; Hanisch et al., 2016; Mojtabai et al., 2011; Rüsch & Thornicroft, 2014), and it has been associated with the underutilisation of workplace mental health interventions such as workplace counseling and employee assistance programmes (Hanisch et al., 2016). By addressing the stigma of mental illness in the workplace it is likely that employers will encourage employees to seek help, and to utilize workplace mental health interventions.

The second recommendation aimed at employers is to support staff to develop IT, literacy and numeracy skills. In the research presented in this thesis, low IT, literacy and

numeracy skills were identified as a barrier to employees engaging with digital mental health interventions. In the qualitative study on organisational perspectives on purchasing digital mental health interventions (Chapter 6), employers estimated that between 10 – 20% of their workforce had low IT skills. In the UK the 2011 Skills for Life survey reported that 9% of adults in paid employment did not achieve government targets for functional literacy, and 19% did not achieve government targets for functional numeracy (Mallows, Carpentieri & Litster, 2016). There is evidence that people with low literacy and numeracy skills are less likely to search for health information online and less likely to use digital health technology (Jensen, King, Davis & Guntzviler, 2010; Kutner, Greenberg, Jin & Paulsen, 2006). By increasing these skills amongst workers, it may be possible to increase confidence in accessing digital mental health treatments.

The third recommendation aimed at employers is to work with employees to increase access to digital equipment and the private space needed to access digital mental health interventions. In this research, the lack of necessary equipment to access digital health interventions was described as a barrier by employers, and the lack of private space to access the interventions was identified as a barrier by employees.

The final recommendation is for employers to circulate information about digital mental health interventions and to encourage their use. In this research, employees identified the important role of organisational leaders in promoting and encouraging the use of digital mental health interventions. The role of organisational leaders in promoting good health in the workplace has long been established (e.g. Eriksson, Axelsson Axelsson, 2011; Gurt, Schwennen & Elke, 2011; Jiménez, Winkler & Dunkl, 2016). Eriksson et al. (2011) identified three main categories of health promoting leadership: organising health-promoting activities, having a supportive leadership style, and developing a health-promoting workplace. Providing access to these interventions and promoting their use enables organisational leaders to demonstrate their commitment to health promotion activities.

Users

The only recommendation arising from this research for users of occupational digital mental health interventions is to set the intention and prioritise the time to use the intervention. In this research, employees described the main barrier to engaging with digital mental health interventions in the workplace as the lack of time. Time constraints have been identified by other studies on digital health interventions delivered in the workplace as a reason for disengaging from interventions (Abbott, Klein, Hamilton & Rosenthal, 2009a; Abbott et al., 2009b; Geraedts et al., 2014; Persson Aaplund et al., 2017). One way to overcome this barrier may be through users scheduling a weekly session in their diary (Donkin & Glozier 2012). A recent review of predictors of adherence to digital health interventions concluded that planning was the strongest predictor of adherence to digital health interventions; participants who had made concrete plans about when and how they would access the intervention, and how they would overcome potential difficulties were more likely to adhere to the intervention (Zarski et al., 2018).

7.2.2 Recommendations for increasing uptake from employers

To maximise the number of employees with access to occupational digital mental health interventions, we need to ensure that these interventions meet both the needs of the intervention users (employees), and the intervention purchasers (employers). Recommendations about actions that can be taken by developers and researchers to increase uptake of these interventions by employers is presented in Table 7.2 and discussed below.

Table 7.2: Recommendations for increasing employer uptake of digital mental health interventions

Developers	<ul style="list-style-type: none"> • Co-design interventions with stakeholders including employers and employees.
Researchers	<ul style="list-style-type: none"> • Conduct research that is relevant to organisations, reflects their concerns and priorities, and is situated in a work environment. • Conduct economic evaluations of occupational digital mental health interventions. • Present and disseminate research to non-academic audiences. • Develop evaluation frameworks that are more sympathetic to the iterative and rapid process of technological development.

Developers

Digital health interventions have rarely been designed with input from the end users:

The field has generally designed interventions to try and get people to do what experts believe is beneficial and has paid far less attention to what users want or how to fit tools into the fabric of users' lives. (Mohr, Lyon, Lattie, Reddy & Schueller, 2017; "Design," para. 1).

Resulting in many interventions failing to be sustainably and effectively implemented (Mohr, Lyon et al., 2017; Mohr, Weingardt, Reddy & Schueller, 2017b).

To ensure that digital mental health interventions are: 1) engaging and beneficial to their users, 2) fit into the fabric of an organisational context, 3) meet the needs of gatekeepers (e.g. employers and other purchasers), and 4) are sustainably and effectively implemented in real world settings, this thesis recommends that developers work with stakeholders to co-design digital mental health interventions. Co-design (also known as participatory design, co-creation, and co-production) describes a design process that actively involves all stakeholders in the design of a new product, service or process

(Szebeko & Tan, 2010). The key principle of this approach is to view all participants in the co-design process as equal and valued partners in the development and decision-making process (Szebeko & Tan 2010). Co-design is similar to user-centred design, but user-centred design doesn't have the principle of equality between stakeholders and doesn't always actively involve end users (or other stakeholders) in the design and evaluation of the product, it may just ground the design process in "information collected about the individuals and settings where products will ultimately be used" (Lyon & Koerner, 2016, p.180).

One of the benefits of co-design is that it moves "research out of the ivory towers and closer to the real world" (Greenhalgh, Jackson, Shaw & Janamian, 2016, "Conclusion," para. 2). A recent paper on collaborations in the development of digital mental health interventions (Calvo, Dinakar, Christensen & Torous, 2018) identified the need for more diverse collaborations including those with mental health professionals, designers, data scientists and end users. Challenges to these collaborations were identified as problems with intellectual property, the different lexicons and priorities of stakeholders, and the tension between industry incentives (return on investment and profit) versus research goals. There is also a difference in the timescales of academics (long time scales) and industry (short timescales). However, despite these challenges, co-designing interventions are likely to result in well-designed, contextually appropriate, and evidence based interventions (Lyon & Koerner, 2016), which may be more appealing to employers and users.

Researchers

The first recommendation aimed at researchers to increase employer uptake of digital mental health interventions is to conduct research that is relevant to organisations, that reflects their concerns and priorities, and is situated in the work environment. The systematic review and meta-analysis on the efficacy of occupational digital mental health interventions reported in this thesis (Chapter 3) found that despite these interventions being delivered in the workplace, very few incorporated measures of occupational outcomes (e.g. increasing engagement or productivity, reduction in absenteeism or presenteeism). Employers reported in the qualitative study (Chapter 6)

that it was important to them that outcome data was both relevant to the workplace and that it was gathered in a work environment and not a health or community setting.

The second recommendation in this thesis aimed at researchers to increase employer uptake of digital mental health interventions is to conduct economic evaluations of these interventions as they are delivered in the workplace. The purpose of economic evaluations of digital health interventions is that they help inform decision makers about the relative value of these interventions compared with other alternatives (McNamee et al., 2016). Previous research (Semmer, 2006) has suggested that economic arguments for investment in health interventions are unlikely to be effective because human decision-making isn't always rational, there is widespread disinterest in these studies, and managers who support health interventions don't always consider the financial aspects. In contrast, the qualitative study in this programme of research on the perspective of individuals making (or influencing) financial decisions about digital health interventions (Chapter 6) suggests that organisations would welcome economic evaluations, but they would like to see them conducted in the context of organisations similar to them. Other researchers have also identified the importance of rigorous economic evaluations of digital health interventions (Michie, Yardley, West, Patrick & Greaves, 2017).

One of the challenges of conducting economic evaluations in an organisational context is that the benefits of workplace health promotion activities may be less obvious in the short term (Dunkl & Jiménez, 2017), and it may be difficult to isolate the effect of a digital mental health intervention when it is delivered in the context of a broader occupational health programme. However, despite these challenges, good quality economic evaluations have the potential to help employers make evidence based decisions about the allocation of resources to digital mental health interventions.

The third recommendation for researchers is to disseminate research to non-academic audiences. In the qualitative study conducted for this research programme (Chapter 6), employers were not fully aware of the potential of digital health interventions. The majority of participants in the study described digital health interventions as delivering psychoeducation in the form of a static webpage. It is important that researchers

working in the field of occupational digital mental health share their research with non-academic audiences so that there is a better understanding of the potential of these interventions.

The final recommendation is that researchers develop evaluative frameworks that are more sympathetic to the iterative and rapid process of technological development. By developing these frameworks, it is more likely that validated technologies will reflect current provision and be more appealing to purchasers including employers. In the systematic review and meta-analysis on the effectiveness of occupational digital mental health interventions (Chapter 3), it was reported that only two of the 21 studies included in the review used a mobile phone app; this small number of apps did not appear congruent with the large number of health apps in the market that are currently available to download. One reason for the delay between new digital interventions being developed and them appearing in the academic literature may be the slow pace of intervention evaluation and academic research publication. One of the dangers of this delay is that mental health technologies can be out-dated and obsolete by the time they are validated (Mohr et al., 2017b).

Intervention research in psychology is based on evaluations developed for the pharmaceutical industry. The five phases of evaluation are: 1) intervention generation and refinement; 2) efficacy in research setting; 3) efficacy in community settings; 4) effectiveness; and 5) implementation (Mohr, Lyon et al., 2017). As well as the inefficient process of evaluation (Mohr, Lyon et al., 2017), research can also suffer from the cumbersome and slow process of academic publishing (Calvo et al., 2018). These problems are compounded in digital health when we compare them with the fast-moving pace of technological innovation, the increasing consumer appetite and expectations, and the increasing need and desire of the National Health Service in the UK (and elsewhere) to reduce health service costs through the innovative use of technology.

As well as a fast pace of technological change, software developers are adopting lean (or agile) product development processes (see Ries, 2011), which advocate a highly iterative development process with assessment and testing being conducted alongside

development and implementation. The fast pace of technological change, and the dynamic product development cycles are unsuitable for the existing evaluation processes (Michie et al., 2017). This is particularly problematic when there is a pressing need for developing an evidence base for the widely available health apps that are currently being downloaded (Bauer et al., 2017; Leigh & Flatt, 2015).

One solution to overcoming some of the challenges of digital mental health intervention development, evaluation and implementation is to develop an iterative design and evaluation process. Mohr, Lyon et al. (2017) developed the Accelerated Creation-to-Sustainment (ACTS) model, which uses an iterative design and evaluation process across three phases (Create, Trial and Sustain) to accelerate research and integrate design, evaluation and sustainable implementation of digital interventions (described by Mohr, Lyon et al., 2017 as technology enabled services). The three phases are depicted below in Figure 7.1. The aim of the Create phase is to develop a service protocol, minimally viable products, and a draft implementation plan. Evaluation at this phase is predominantly qualitative. The aim of the Trial phase (the Optimising, Effectiveness, and Implementation (OEI) hybrid trial phase) is to optimise the intervention so that it meets its clinical objectives and is usable to all stakeholders, evaluate its effectiveness in real world settings, and successfully implement the intervention. Effectiveness outcomes (patient-level clinical outcomes) and implementation outcomes (adoption, uptake, treatment fidelity, costs and cost effectiveness, and efficiency) are tested simultaneously. Evaluation becomes more quantitative in the Trial phase. The Sustain phase involves the removal of the research infrastructure and support to leave a sustainable intervention. Evaluation at this stage is predominantly unobtrusive, automated measurements. Mohr, Lyon et al. (2017) emphasise the importance of user-centred design to the ACTS model. By adopting fast paced design and evaluation processes it is more likely that the gap between intervention development, research and validation is shortened and that validated interventions reflect the latest technological innovations and are more appealing to employers.

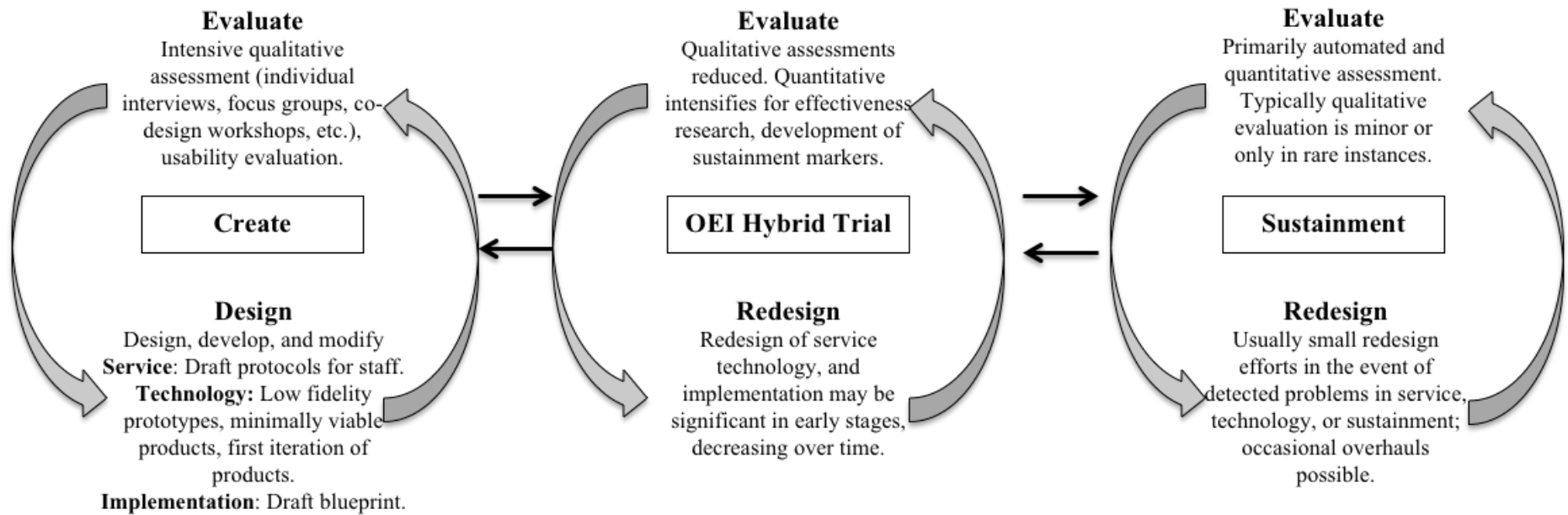


Figure 7.1: Accelerated Creation-to-Sustainment Model (Mohr, Lyon et al., 2017)

7.3 Comparison of recommendations with theoretical frameworks of engagement and adherence

This section describes how the recommendations for increasing adherence to digital health interventions made in this thesis compare with other theoretical frameworks of intervention engagement and adherence. Comparisons with theoretical frameworks are made here and not in the Chapter 1 because the exploration of engagement in this thesis was inductive rather than theory-driven.

A number of theoretical frameworks and models have been proposed to explain or describe engagement and adherence to Internet interventions (e.g. Brouwer et al., 2011; Cavanagh & Millings, 2013; Kelders et al., 2012; Ludden et al., 2015; O'Brien & Toms, 2008; Perski, Blandford, West and Michie, 2017; Ritterband, Thorndike, Cox, Kovatchev, & Gonder-Frederick, 2009; Schubart, Stuckey, Ganeshamoorthy & Sciamanna, 2011). The diverse conceptualisation of the term engagement makes it challenging to synthesise the proposed models (Yardley et al., 2016). For example, O'Brien and Toms (2008) define engagement as the quality of the user experience with technology; Brouwer et al. (2011) define engagement as exposure to the intervention (e.g. number of logins, time spent on the website); Cavanagh and Millings (2013) define engagement as adherence to the intervention; and Schubart et al. (2011) define engagement as the interaction with the Internet programme (e.g. mouse clicks, completing a quiz, number of visits). As well as the diversity of the conceptualisation of engagement, there is also diversity in the conditions that are being targeted. For example Brouwer et al. (2011) focused on Internet programs aimed at preventing physical chronic disease (e.g. smoking cessation, weight management, alcohol reduction); Cavanagh and Millings (2013) focused on computerised CBT programs delivered in clinical settings for patients with common mental health disorders (e.g. anxiety, depression); and Schubart et al. (2011) focused on Internet programs designed to manage chronic disease (e.g. eating disorders, chronic pain, cardiovascular disease). Despite these challenges to synthesising the models, Short, Rebar, Plotnikoff & Vandelanotte (2015) developed a model of user engagement with Internet interventions which amalgamates a number of the studies mentioned above and is based on a synthesis of the research from social psychology, information science and marketing.

The model is presented below in Figure 7.2. In this model, engagement is seen as an interaction between the individual's environment, the individual, and the intervention. Increased motivation to engage with digital interventions occurs when intervention content is perceived as personally relevant to the user, and when the content and the way that it is presented is matched by the individual's characteristics, skill level and expectations. Disengagement can be motivated by negative emotions experienced as a result of a mismatch between the intervention and the user's expectations of the interventions, or it can occur as a result of positive emotions such as satisfaction with progress and the achievement of a personal goal.

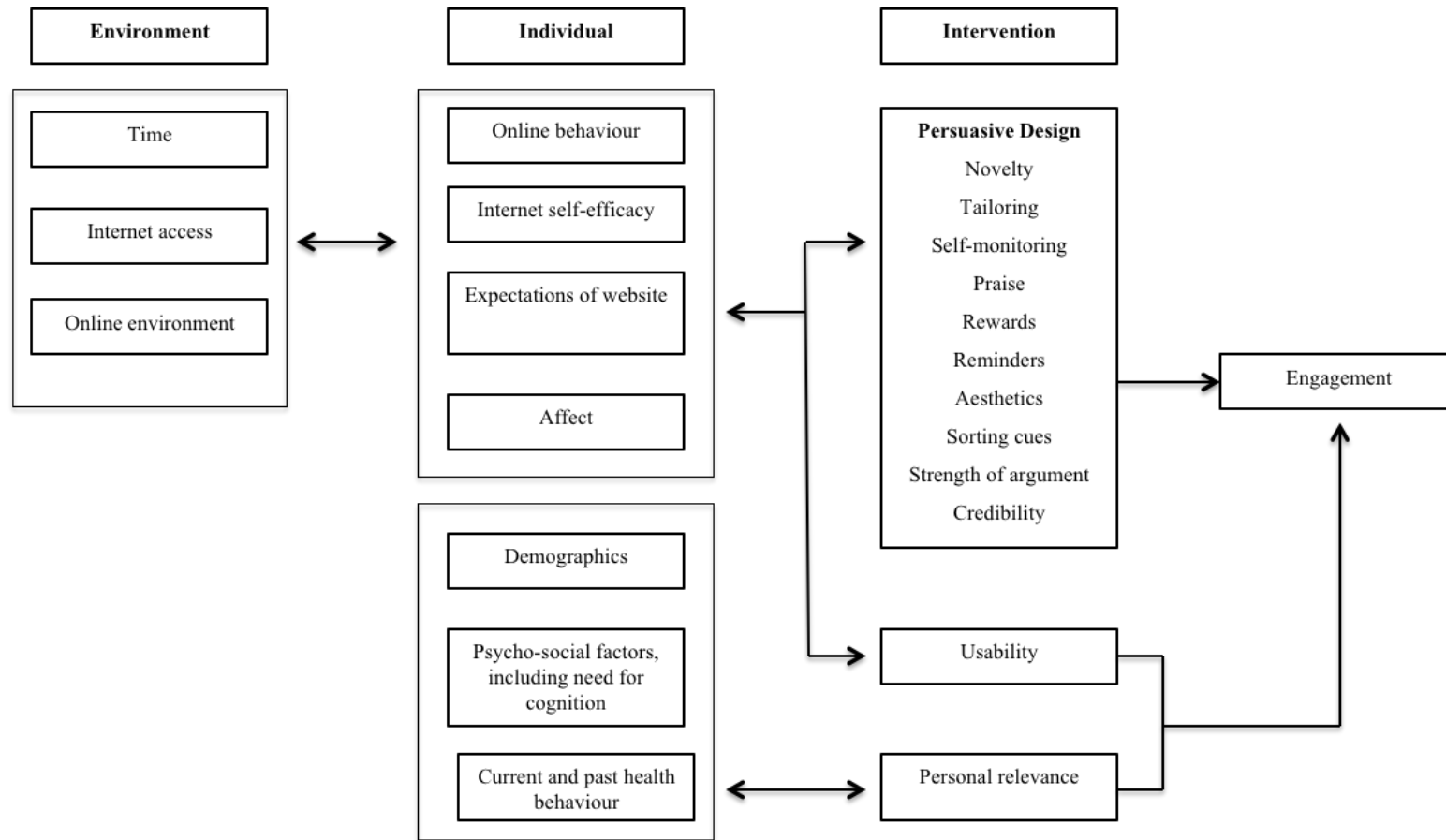


Figure 7.2: Model of user engagement with online interventions (Short et al., 2015)

The qualitative studies in this thesis took an inductive approach, and were not designed to test theoretical frameworks. It is interesting to note however, the similarities between Short et al.'s (2015) model and the recommendations made in this thesis: both conceptions of engagement with digital health interventions acknowledge the importance of the environment which includes access to time to engage with the intervention, and access to digital equipment including the Internet; and both identify design and content features that support engagement including tailoring and self-monitoring, reminders to login, visual appeal, usability and personal relevance. Short et al.'s (2015) model has a more comprehensive focus on the individual including demographic factors and current and past health behaviour; user characteristics was not a focus of the studies in this programme of research.

None of the previous conceptualisations of engagement with digital health interventions focused on an occupational setting. The recommendations made in this thesis specifically identify the importance of the context in which the intervention is being delivered (i.e. the workplace). It also identifies the important role of organisational gatekeepers (e.g. occupational health, line managers) in helping workers to access and engage with these interventions, and the role of researchers in making relevant and accessible information available to ensure that these gatekeepers can make informed purchasing decisions. Within an occupational setting, workers will not get an opportunity to engage with or adhere to evidence based digital mental health interventions if organisations cannot be persuaded to make these interventions available.

The studies in this thesis suggest that the factors identified in Short et al.'s (2015) model can be optimised in an occupational setting through a partnership between developers, researchers, employers and users. Increasing adherence to digital interventions comes through the principles of co-design: where developers work with all stakeholders to develop effective interventions that are appealing to both employers and employees, and where researchers provide an evidence base that is relevant to employers and helps them to make informed purchasing decisions.

The recommendations in this thesis add to the body of literature by exploring the impact of an occupational setting on adherence to digital mental health interventions, it considers the role of employers in increasing access to these interventions, and it identifies the role of researchers in providing employers with the information that they need to make informed purchasing decisions.

7.4 Reflections on the research

In the reflexive account given in Section 2.8, I reflected on my role as a researcher and the steps that I took in this programme of research to ensure transparency. In this section I reflect more broadly on the findings of the research programme: how my roles of developer, coach and researcher may have impacted on the findings; whether the findings were expected or surprising; and whether with hindsight I would follow some of the same processes.

I recognise that despite the precautions that were taken to ensure transparency (described in Chapter 2, Methodology), my roles as intervention developer, coach, and researcher may have affected the findings of this research programme. However, I am unsure whether this would have resulted in a dilution or strengthening of effect. My awareness that my role as developer could have led to bias in the research may have resulted in me taking a more conservative approach to data analysis, for example under-emphasising the positive experience that participants reported about using WorkGuru. Equally, it is possible that my roles as developer and coach led to a breadth and depth of knowledge that may have enhanced the quality of the research (especially the processes of data collection and interpretation), resulting in a clearer analysis of the findings. It is important to note that the focus of this programme of research was on adherence to digital mental health interventions delivered in the workplace; it was not on intervention efficacy or effectiveness. I purposely focused the thesis away from the intervention that I had developed (WorkGuru) to explore more widely the impact of the workplace on the delivery of digital mental health interventions. Because of this broader focus, I did not feel that the research programme was about WorkGuru: WorkGuru was a tool that enabled me to explore engagement and adherence, and the context of the workplace. Without having access to a digital mental health intervention, I would not have been

able to explore the impact of the discussion group on engagement, or ground study three in the actual experience of individuals who had access to an occupational digital mental health program.

Some of the findings from this research emerged as expected, for example the finding that the design and content of the intervention were important to encouraging engagement and adherence. I also expected to find that access to an online discussion group would increase the extent that people engaged with the intervention, resulting in improved psychological outcomes. I was disappointed by the unclear findings from the pilot RCT (see 7.5 Limitations of the research programme for a discussion of this), and would have liked the opportunity to take the learning from this exploratory pilot study and conduct a definitive trial. Limited resources and time meant that this was not possible within this programme of research.

There were also some findings that emerged from the programme of research that surprised me, and through that curiosity and surprise influenced the direction of the later studies. In the systematic review and meta-analysis (Chapter 3), it struck me that the interventions used in the studies included in the review did not seem to acknowledge the intended setting of the intervention (the workplace) in either the content or the delivery of the intervention. This then raised several questions: What makes an occupational intervention an occupational intervention - is it purely where the intervention is delivered or does it need to reflect that setting in the content and delivery? Is there something different about the way that people engage with a digital mental health intervention in the workplace compared with a community or health setting? And if so, does the content and delivery of the intervention need to reflect that? These questions directly led to the design of the qualitative studies to enable me to explore these questions in more details.

Another surprising finding emerged from the qualitative study with employees (Chapter 5). This was the important role of employers in promoting digital mental health interventions in the workplace and encouraging their use. From these findings, I became more curious about the role of employers both in terms of them creating an environment that enabled their workers to use these interventions, and in terms of them purchasing

digital mental health interventions for their workforce. The employer as a gatekeeper to these interventions emerged from this study and was explored further in study four (Chapter 6).

There were a number of key decisions made during the development of this research programme that with hindsight remain effective decisions. The first example is the use of mixed methods: this facilitated better understanding of the real world questions that the research programme explored. The second example is the targeting of interventions that were delivered at an individual level rather than an organisational level. Digital interventions are particularly suited for targeting changes in thoughts and behaviours (Ebert et al., 2017a) so are much more likely to be aimed at individuals rather than organisations.

With hindsight, one change I would make was the decision to include only RCTs in the systematic review of digital mental health intervention delivered in the workplace (Chapter 3). The reason for this decision was to minimise the heterogeneity of the included studies to ensure that the meta-analysis was meaningful. With hindsight, this meant that a small number of studies was included in the systematic review. By separating the review from the meta-analysis, a more comprehensive narrative or literature review of both qualitative and quantitative studies could have been conducted, followed by a more focused meta-analysis.

Further, broader limitations to the research programme are discussed in the following section.

7.5 Limitations of the research programme

One of the limitations to this research programme was the generalisability of the findings. Participants recruited to the pilot RCT (Chapter 4) and subsequently to the employee qualitative study (Chapter 5), were predominantly office-based, medium- to highly-educated women. This was not representative of the general workforce. As well as not being representative of the general workforce, participants were recruited electronically (i.e. through email contact) so were more likely to be digitally active. One

of the other limitations related to generalisability is that only a small number of employees from the six organisations involved in the study were recruited, so they are a highly selected group who are more likely to have an interest in digital mental health and are therefore more likely to adhere to the intervention (Mohr et al 2017b). There is also evidence that participants' experience of adherence and engagement may be different in a trial setting compared to a naturalistic setting (Donkin & Glozier, 2012); previous research on adherence to digital health interventions found that participants reported a belief that research is important, as a motivator for persisting with intervention use (Donkin & Glozier, 2012). To address this issue of generalisability, there is a strong need for future research in occupational digital mental health to focus on occupations and industries that are traditionally underrepresented in these studies, particularly blue-collar roles. This is particularly important as there is evidence that occupational groups with lower qualifications, generally experience poorer health than those in higher positions, and workers in lower socioeconomic positions are often in more stressful jobs (Montano, Hoven & Siegrist, 2014). It is also important that researchers work more intensely with a participating organisation to extend the reach of study recruitment so that a more representative employee group is recruited (including employees who are reluctant to engage digitally). To provide a comparison between study participants and the organisation's workforce, researchers may wish to report demographic comparisons between the two groups. They may also wish to report the percentage of the organisation's workforce recruited so that an assessment can be made of the reach of the recruitment.

As well as the factors mentioned above affecting the generalisability of findings, Mohr, Lyon et al. (2017) and Mohr, Weingerdt et al., (2017) suggested that a highly selected group of participants may also impact on the implementation and sustainability of the intervention in real world settings. They described a research-to-practice gap, which is in part explained by selected and targeted recruitment to efficacy trials:

Essentially, clinical researchers have designed tools to try and get people to do what we want them to do and how we want them to do it – and then searched for and found people who were interested in or willing to use those tools in our trials. (Mohr et al., 2017b, p428).

When researchers encounter problem with recruiting to their trials they expand their sources of recruitment until eventually they find people willing to use their intervention (Mohr et al., 2017b), the unintended consequence of this is that we build digital health interventions that work for a small, select group. One way to address this concern might be through developing and evaluating digital interventions using the co-design approach recommended by Mohr, Lyon et al., (2017) and Mohr, Weingardt et al., (2017) and discussed in this chapter.

Another limitation of this research programme was unclear findings from the secondary measures on the pilot RCT (Chapter 4). The trial reported that the primary measure of engagement (as measured by the number of logins) with the intervention increased when participants accessed it alongside a discussion group, but reporting of the secondary measures of psychological outcome and user satisfaction found that participants who accessed the intervention without access to the discussion group benefited more from the intervention and reported higher levels of satisfaction. These confusing outcomes could be a result of unequal experience between groups; because of a delay in recruiting participants, participants randomised to the discussion group had a delay in their group starting. As a pilot, this study was successful as one of the aims of the study was to get a better understanding of the challenges to recruitment. However, greater clarity is still needed about the impact of delivering support through a facilitated discussion group. Further research should continue to look at the benefits of providing coaching support through an online group; and seek to identify the magnitude of additional benefit (e.g. increased engagement, increased reach) in relation to the magnitude of additional cost.

The final limitation to this programme of research was the fast-moving nature of digital health technology. The programme of research reported in this thesis predominantly focused on adherence to Internet interventions as opposed to mobile technology. While there is currently insufficient empirical evidence to support any mental health mobile app as evidenced based (Lui, Marcus & Barry, 2017; Moller et al., 2017; West & Michie, 2016), emerging research in this field is promising. It is likely, however that factors that encourage adherence to mobile technology will be different to those that encourage adherence to Internet interventions, and that the environments in which these

mobile technologies are being accessed will be different to current Internet interventions (Yardley et al., 2016). It is also likely that mobile technology will have the potential to reach a different group of users. More research is needed to realise the potential of mobile technology, and to understand engagement and adherence in the context of these new interventions.

7.6 Conclusion

In conclusion, this thesis has addressed a number of gaps in the research literature, and contributed to our knowledge about the way that digital mental health interventions are delivered and received in the workplace in a number of ways. First, the systematic review and meta-analysis (chapter 3) provided evidence that these digital interventions can be an effective means for delivering mental health treatment in the workplace. Second, the pilot RCT (Chapter 4) showed that access to an online facilitated discussion group resulted in increased exposure to the intervention (as measured by the number of logins). Third, findings from the qualitative study with employees (Chapter 5) suggested that the convenience, flexibility and anonymity of digital mental health interventions helped employees to engage with them, but in a workplace setting they could also act as barriers to engagement. Fourth, findings from the qualitative study with employers (Chapter 6) identified the number one priority when considering purchasing a digital mental health intervention as cost, followed by efficacy. Fifth, the qualitative study with employers also identified the importance to employers that research addresses the concerns and priorities of organisations and that it is conducted in a workplace setting. Sixth, barriers to delivering these interventions in the workplace were identified by employers as the low interest and skills of employees. Seventh, the novel research presented here identified a number of recommendations aimed at developers, employers and users for improving adherence to occupational digital mental health interventions, it also highlighted the role of employers in acting as gatekeepers to these interventions, and it identified recommendations for increasing employer uptake. Overall, this programme of research identified the importance of recognising the context of the workplace in both the content and the delivery of these interventions, and suggests that a more sustainable and effective way to develop and evaluate digital mental health intervention may be through a co-design process.

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Appendix 1: Pilot RCT Study Protocol

Increasing engagement with an occupational digital mental health intervention; Study protocol for a pilot RCT

Carolan, S., Harris, P. R., Greenwood, K., & Cavanagh, K. (2016). Increasing engagement with, and effectiveness of, an online CBT-based stress management intervention for employees through the use of an online facilitated bulletin board: study protocol for a pilot randomised controlled trial. *Trials*, 17(1): 598.

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1.1 Abstract

Background: The evidence for online cognitive behaviour therapy (CBT) based programs delivered in a clinical context is clear, but this evidence does not translate to online CBT based stress management programs delivered within a workplace context. One of the challenges to the delivery of online interventions is program engagement; this challenge is even more acute for interventions delivered in real world settings, such as the workplace. The purpose of this pilot study is to explore the effect of an online facilitated discussion group on engagement, and to estimate potential effectiveness of an online CBT based stress management program.

Methods: This study is a three-arm randomised controlled trial (RCT) comparing a minimal guided online CBT based stress management intervention delivered with and without an online facilitated bulletin board, and a wait list control. Up to 90 employees from six UK based organisations will be recruited to the study. Inclusion criteria will include age 18 or over, elevated levels of stress (as measured on the PSS-10 scale), access to a computer or tablet and the Internet. The primary outcome measure will be engagement, as defined by the number of logins to the site; secondary outcome measures will include further measures of engagement (the number of pages visited, the number of modules completed and self-report engagement), and measures of effectiveness (psychological distress and subjective wellbeing). Possible moderators will include measures of intervention quality (satisfaction, acceptability, credibility,

system usability), time pressure, goal conflict, levels of distress at baseline and job autonomy. Measures will be taken at baseline, 2 weeks (credibility and expectancy measures only), 8 weeks (completion of intervention) and 16 weeks (follow-up). Primary analysis will be conducted on intention to treat principles.

Discussion: To our knowledge this is the first study that will explore the effect of an online discussion group on the engagement and effectiveness of an online CBT based stress management intervention. This study could provide a solution to the growing problem of poor employee psychological health and begin to address the challenge of increasing engagement with Internet delivered health interventions.

Trial registration

Registered with ClinicalTrials.gov on March the 18th 2016 NCT02729987

Key words

Online - Internet - CBT - stress - work

1.2 Background

One in six adults in England meet the diagnostic criteria for at least one common mental health problem, but only 24% of them are receiving any form of treatment (McManus, Meltzer, Brugha, Beddington, & Jenkins, 2009). Psychological ill health is the leading cause of sickness absence in the UK accounting for 70 million sick days in 2013 and costing the economy £70-£100 billion per year (Davies, 2014). Reducing the prevalence of common mental health problems is a major public health challenge (McManus et al., 2009). One approach to addressing this challenge is to utilise the Internet as a means of delivering evidence-based psychological treatments.

In 2013, 73% of adults in Great Britain used the Internet every day, with 43% using the Internet to seek health information (ONS, 2013). The Internet has become a natural means for delivering healthcare information (Tustin, 2010), treatment, and prevention programs (Strecher, 2007). In the UK, computerised CBT (cCBT) is endorsed by the National Institute for Health and Care Excellence (NICE 2009) for the treatment of

persistent subthreshold depressive symptoms or mild to moderate depression. NICE have also identified cCBT as a promising low-intensity intervention for Generalised Anxiety Disorder (NICE 2011).

A large number of meta-analyses have found evidence for the delivery of online CBT based programs delivered in clinical or community settings for individuals with depression and anxiety (Andersson & Cuijpers, 2009; Andrews, Cuijpers, Craske, McEvoy & Titov, 2010; Cuijpers et al., 2009; Richards & Richardson, 2012; Spek, Cuijpers, Nyklicek & Riper, 2007), but the evidence for online psychological interventions delivered in workplace settings is less convincing (Geraedts et al., 2014; Grime, 2004; Philips et al., 2014).

Researchers have argued that adherence (completing the intervention to the extent that the developers intended it to be used; Kelders, Kok, Ossebaard, & Van Gemert-Pijnen, 2012), engagement (the extent, both in terms of time and frequency, that participants visit the website), and attrition (participants in a study who do not fulfill the research protocol; Kelders et al., 2012) all pose challenges to the evaluation and delivery of Internet interventions (Cavanagh & Millings, 2013; Eysenbach, 2005; Kohl, Crutzen, & de Vries, 2013). For Internet interventions delivered in real world settings (as opposed to clinical research settings), these challenges can be even more acute (Christensen, Griffiths, Korten, Brittliffe, & Groves, 2004; Gilbody et al., 2015) with as few as 1% of registered users completing all sessions of a freely available online CBT program for people with panic disorder and agoraphobia (Farvolden, Denisoff, Selby, Bagby, & Rudy, 2005).

Evidence suggests that increasing guidance from a therapist can lead to greater adherence to online interventions, and result in improved outcomes (Andersson & Cuijpers, 2009; Brouwer et al., 2011; Hilvert-Bruce, Rossouw, Wong, Sunderland & Andrews, 2012; Kelders et al., 2012; Mohr, Cuijpers & Lehman, 2011; Palmqvist, Carlbring & Andersson, 2007; Spek et al., 2007). A facilitated discussion group delivered in the form of a bulletin board could provide a cost effective and time efficient means for increasing guidance from a therapist. Although more evidence is needed to support this hypothesis, there is some evidence of improved adherence to bulletin board

support: Titov, Andrews, Choi, Schwencke, and Mahoney (2008), compared guided and non-guided Internet-based CBT for social phobia. The guided condition had access to a facilitated bulletin board and email contact from a therapist. The unguided condition had access to a non-facilitated bulletin board. The study found that adherence rates for the supported condition were higher than for the unsupported condition (77% and 33% respectively). What was unclear from the study was the extent to which it was the facilitated bulletin board or the email support that successfully provided the additional therapist guidance.

A number of other studies (Andersson et al., 2005; Berger et al., 2011; El Alaoui et al., 2015) have also included discussion groups delivered in the form of bulletin boards as part of an online intervention but have failed to include the groups as a unique research variable so have been unable to identify the impact of the group on the effectiveness of the intervention.

In this study we will examine the effect of an online facilitated bulletin board on engagement with an online CBT based stress management program (WorkGuru) and explore whether effectiveness is mediated by engagement. We hypothesise that the bulletin board group will have better engagement outcomes than the minimal support group (MSG), and that these outcomes will result in decreased levels of psychological distress and increased levels of subjective wellbeing at work. Furthermore, we expect to identify moderating factors that influence levels of engagement and effectiveness that are either linked to the quality of the intervention (satisfaction, acceptability, credibility, system usability), time pressure, goal conflict, level of distress at baseline, or job autonomy.

This study is being conducted as a pilot phase of a substantive trial; this will give greater confidence in predicting effect size, refining the optimum engagement of the intervention (adherence) and understanding the accuracy and effectiveness of engagement measures. It will also give a greater understanding of the challenges of conducting this research in a workplace setting.

1.2.1 Aim of the study

The aim of this pilot study is to inform a definitive randomised controlled superiority trial. The objectives are:

- a) To assess recruitment rate, level of study attrition, and the robustness of engagement measures.
- b) To provide an effect size prediction.
- c) To get a better understanding of the extent to which participants are engaging with the modules and the bulletin board so that threshold levels of adherence can be refined.
- d) To identify challenges of conducting research, and delivering an online intervention in the workplace.

1.3 Method

1.3.1 Study design

A three-arm RCT will be conducted to compare engagement and effectiveness of a minimal guided online CBT based stress management intervention (WorkGuru) delivered with and without an online facilitated bulletin board. Both active conditions will be compared with a wait list control (WLC). All participants will have unrestricted access to care as usual (CAU) such as counselling and medication, which will be monitored to control for potential confounding effects. The trial will be conducted and reported in line with Consolidated Standards of Reporting (CONSORT) 2010 guidelines (Schulz, Altman & Moher, for the CONSORT Group, 2010). A completed Standard Protocol Items: Recommendations for Interventional Trials (SPIRIT) 2013 checklist and chart (see Table App.1) has been completed and submitted for publication. Online assessments will be conducted before randomisation, at two weeks (credibility/expectancy measure only), on completion of treatment (8 weeks), and at 16-week follow-up (see Figure App. 1).

Table App. 1: Standard Protocol Items: Recommendations for Intervention Trials (SPIRIT) schedule of enrolment, interventions and assessment

	Study period (weeks)									
Timepoint	3/16	4/16	5/16	6/16	7/16	8/16	9/16	10/16	11/16	
Enrolment										
Recruitment	X	X	X	X						
Eligibility screen	X	X	X	X						
Informed consent	X	X	X	X						
Allocation	X	X	X	X						
Interventions:										
Discussion group	X	X	X	X	X	X				
Minimal support group	X	X	X	X	X	X				
Wait list control (access to MSG)					X	X	X	X	X	
Assessments										
T1	X	X	X	X						
Credibility/Expectancy	X	X	X	X	X					
T2			X	X	X					
T3					X	X	X			
Study completion										X

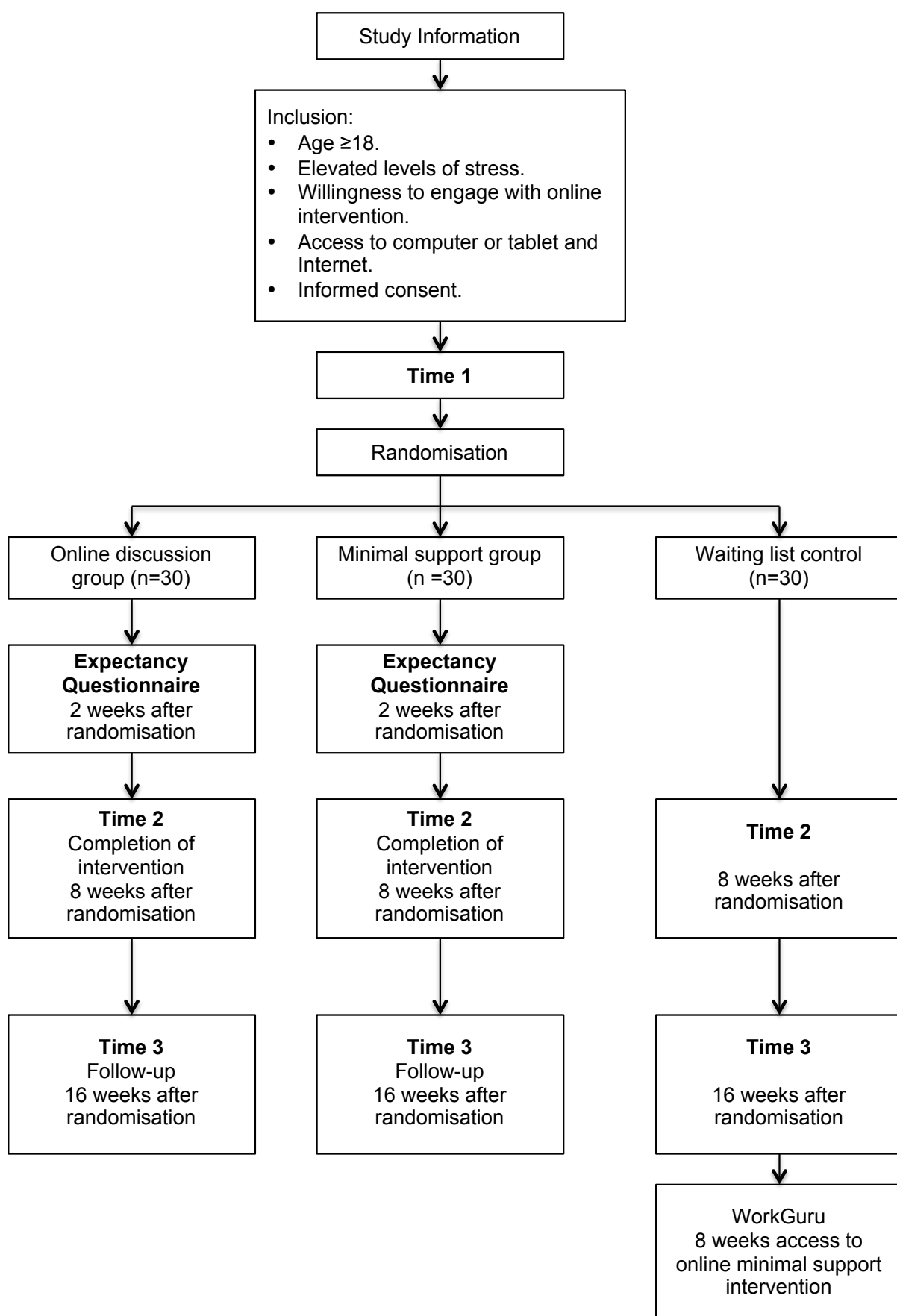


Figure App. 0.1: Study flow chart

1.3.2 Recruitment and randomisation

Six UK based organisations will be approached to participate in this study. A sample size of 90 study participants will be recruited from the participating organisations. The sample size of 30 participants per arm is based on the optimum number of discussion group participants identified by WorkGuru, and is equal to the medium per arm sample size identified in an audit of sample sizes for pilot and feasibility studies (Billingham, Whitehead, and Julious, 2013). Participants will be recruited through advertisements distributed via email, the organisations' intranets and in-house magazines. All marketing information will include an email address inviting people who are interested in participating in the study to access information made available online or email the first named author (SC). An information leaflet and a link to the online screening questionnaire, the short-form version of the Perceived Stress Scale (PSS-10; Cohen, Kamarck & Mermelstein, 1983) will be made available to all people who express an interest in the study. People who meet the inclusion criteria will automatically be sent a link to the online baseline questionnaire. The online questionnaires will be designed and distributed using Qualtrics survey software. Participants that complete the baseline questionnaire will be randomised. The first author will create an allocation schedule using a computer generated randomisation sequence (random.org). An independent researcher not otherwise involved in the research will allocate each group (A, B or C) as an active condition (with or without a facilitated bulletin board) or as the WLC. Participants will be randomly allocated on a ratio of 1:1:1 to these groups. The study researchers will be blind to the group allocation.

Randomisation is being conducted at an individual level rather than at organisation or team level. This allows us to control for group stressors such as large-scale redundancies and team deadlines. One of the risks of individual level randomisation is contamination between the groups (i.e. participants in the WLC talking with participants in an active intervention). The extent of contamination between the study groups will be monitored.

Participants using the bulletin board will be required to use a pseudonym to maintain researcher blindness. Individual level randomisation has been chosen to control for group stressors (i.e. organisational, department or team change).

1.3.3 Inclusion and exclusion criteria

Inclusion criteria will be: age 18 or over, employed by participating organisation, willingness to engage with an online CBT based stress management intervention, access to a computer or tablet, access to the internet, and a score of ≥ 20 on the PSS-10. No exclusion criteria have been set.

1.3.4 Intervention

The online CBT based stress management intervention WorkGuru is presented on a secure platform that participants log on to using email addresses and a self-generated password. WorkGuru is a modular intervention that is based on the psychological principles of CBT, positive psychology, mindfulness and problem solving. It has been designed to increase self-awareness, improve flexible thinking and teach active coping skills. There are 10 modules that individuals can select to complete (see Table App. 2 for more information). Seven of those modules comprise the core modules, which all participants will be advised to complete. The modules consist of a combination of educational reading and audio, short animations, and interactive exercises. Participants can complete a questionnaire and receive suggestions for modules they may find useful, or they can choose the modules themselves. As well as the modules, participants can complete 8 self-monitoring standardised questionnaires, for example: the Perceived Stress Scale (Cohen Karmarck, & Mermelstein, 1983), the Subjective Happiness Scale (Lyubomirsky & Lepper, 1999), and the Brief Resilience Scale (Smith et al., 2008). Participants have the option to opt-in to a weekly email (the Monday Morning Message) that will reinforce messages of positive thinking and healthy working practices. They can also set themselves email reminders to visit the site. To encourage engagement, the coach will contact each participant through the site three times during the course of the eight-week program (when an account is created, at two weeks and at six weeks). Participants can choose to share their work with the coach, and to contact the coach at anytime through the site to ask for feedback or additional help or advice. The coach will

respond within 24 hours. The coach has a postgraduate level qualification in executive coaching.

Throughout the content of the WorkGuru website, users are prompted that if they are concerned about their mental health they should speak to their GP, NHS 111 or the Samaritans. Contact details are given.

Table App. 2: WorkGuru modules

	Module title	Module content	Suggested completion time
1.	Learn about me and my values*	Two questionnaires designed to help identify and prioritise work and life values. Exercise to prioritise those values	70 min
2.	Identify the things that cause me stress*	Psycho-educational information on stress, a stress diary and an exercise designed to help individuals analyse their stress diaries looking for patterns to their stress trigger, and the helpful and not so helpful ways they respond to stress	90 min (plus Stress Diary)
3.	Recognise the early warning signs of stress*	Psycho-educational information on stress and an exercise to help identify physical, psychological and behavioural symptoms of stress	20 min
4.	Learn about how I think*	Brief CBT including cognitive restructuring, automatic thoughts and unhelpful thinking styles	30 min (plus Thought Diary)
5.	Resilience learning to bounce back*	Psycho-educational material on positive psychology and nine 'happiness' exercises focusing on increasing positive thinking	40 min (plus exercises to be completed over a number of weeks)
6.	Manage my stress*	Identifying demands that are made and things that can be done to increase capacity to cope. Planning how to decrease demands and increase capacity to cope	60 min
7.	Working smarter not harder*	Exercise and psycho-educational material on prioritising, focusing energy, learning to let go and time management	90 min (plus an option of a diary)
8.	Thinking about where I want to be in the future	Exercises to help imagine the best possible and steps needed to get there.	30 min
9.	Mindfulness	An introduction to mindfulness with guided meditations	90 min
10.	Explore creative ways to problem solve	Exercises introducing problem solving techniques	60 min

Note: * Core module

1.3.5 Minimal support group (MSG)

The MSG will have full access to the intervention as described above, including direct messaging support from the coach.

1.3.6 Online discussion group

As well as accessing the online modules, and the direct messaging support from a coach, the online discussion group will also have access to an eight-week online facilitated discussion group delivered via a bulletin board. The discussion group will be facilitated by a coach in groups of 30. The coach will introduce one or more modules each week and encourage discussion about the topic. Participants will be required to select a user name, so that they will be anonymous in the group.

1.3.7 Wait list control group (WLC)

The WLC will have access to the minimal support intervention (the online modules and direct messaging support from a coach) after 16 weeks.

1.4 Measures

1.4.1 Screening measure

A score of ≥ 20 on the PSS-10 has been identified as inclusion criteria for this study. The cut off of 20 represents one standard deviation (6.35) above the mean (13.02) in a large ($n=2,387$) US general population sample (Cohen & Williamson, 1988). PSS-10 was chosen because it was felt that stress was something that employees could readily relate to (as opposed to anxiety or depression), and it is a widely used and validated scale that has been designed to measure the extent to which individuals perceive aspects of their life in that last month as being uncontrollable, unpredictable, and overloading. In a review of the scale Eun-Hyun (2012) reported a Cronbach's alpha and a test-retest reliability of $>.70$. The author concluded that the psychometric properties of PSS-10 are superior to those of PSS-14, and recommend that PSS-10 should be used both in practice and research.

1.4.2 Primary and secondary outcome measures

The primary outcome measure of the study is engagement (the number of logins to the site); the secondary outcome measures include further engagement measures (the number of pages visited, the number of modules completed, and self-report engagement), and measures of effectiveness (the English language short-form version of the Depression, Anxiety, Stress Scale (DASS-21; Lovibond & Lovibond, 1995) and the wellbeing at work indicator (IWP Multi-Affect Indicator; Warr, 1990)). The DASS-21 has been designed to measure the negative emotional states of depression, anxiety and stress. In a review of the scale Henry and Crawford (2005) reported a Cronbach's alpha of .93. The scale was described as moderately sensitive to change in a depressed clinical sample (Page, Hooke & Morrison, 2007). The IWP Multi-Affect Indicator is a 16-item measure of subjective wellbeing at work. Alpha coefficients for this scale range from .75 to .90 (Warr, Bindl, Parker & Inceoglu, 2014).

1.4.3 Other measures

Client Satisfaction Questionnaire (Larsen, Attkinson, Hargreaves, & Nguyen, 1979). The CSQ is an eight-item questionnaire that has been developed to assess general satisfaction with services. It has a high degree of internal consistency ($\alpha = 0.93$; Larsen et al., 1979).

A six-item questionnaire developed to rate the acceptability of computerised CBT was adapted from Schneider et al., (2012). Participants were asked to rate the following statements on a five-point scale where 5 is "strongly agree":

1. I can use the computer at my own pace.
2. Using a computer is anonymous. I don't need to tell people about my problems.
3. It is convenient for me to access help via the Internet and not to have to go to a health centre or clinic.
4. I can access help at a time to suit me.
5. The computer will not criticise me.
6. Accessing support online is as acceptable as visiting a counsellor or other mental health professional.

The credibility/expectancy questionnaire was developed by Devilly & Borkovec, (2000) to measure treatment expectancy and rationale credibility for the use in clinical outcome studies. An adaptation of the wording was made to replace “therapy” with “program” and “trauma symptoms” with “stress symptoms”. The authors reported high internal consistency ($\alpha > 0.84$) and good test-retest reliability ($\alpha = 0.82$ for expectancy, and $\alpha = 0.75$ for credibility).

The Online Support Group Questionnaire (Chang, Yeh & Krumboltz, 2001) was used to assess participants’ experience of the group. The authors report Cronbach alphas of the Support, Relevance and Comfort subscales as $\alpha = 0.84$ $\alpha = 0.77$ $\alpha = 0.82$ respectively.

The System Usability Scale (Brooke, 1996) is a 10-item questionnaire which measures a subjective rating of a product’s usability. The test has demonstrated good reliability ($\alpha = 0.91$; Bangor, Kortum & Miller 2008).

The time perception measure (Etkin et al. 2015) is a five-item questionnaire that has a good level of reliability ($\alpha = 0.89$). Participants are asked to indicate on a five-point scale (originally presented by Etkin et al. as a 7 point scale) where 5 is “strongly agree”, the extent to which they agree with the following statements:

1. I have a sense that time is expanded.
2. I have a sense that time is boundless.
3. I have a sense that time is constricted.
4. I always feel as if I am in a rush/hurry.
5. I always feel as if I don’t have enough time.

The goal conflict index (developed for this research) is a three-item questionnaire that asks participants to indicate on a five-point scale where 5 is “strongly agree” the extent to which they agree with these statements:

1. I often feel torn between my work and my home life.
2. I often have a number of competing duties that pull on my time.
3. It is often difficult to prioritise between the different goals in my life.

Job autonomy is measured using the nine-item autonomy subscale of the more comprehensive 77-item Work Design Questionnaire (Morgeson and Humphrey, 2006). The authors report good internal consistency for the autonomy subscale ($\alpha > 0.85$).

To test whether the programme targets a pressing concern, we have included the question: “On a scale of 1 – 10 how important is it to you to reduce your level of workplace stress?”

As recommended by Rozental et al. (2014), we have included a question to identify any possible negative effects of the intervention. Deterioration between pre- and post-treatment will be reported, and the self-report question: “What, if any, positive or negative effects caused by the program/being in the control group did you experience?” will be asked. Existing psychological illness will be monitored with the question: “Have you received a diagnosis of mental illness from your GP or a healthcare professional?” Contamination between the groups will be monitored with the question: “During the course of this study to what extent have you discussed the research with colleagues who were allocated a different research group? (For example if you are in the control group have you spoken with colleagues who are using the online program?).

CAU (including medication for depression or anxiety) will be monitored using the Client Service Receipt Inventory (Beecham & Knapp 1992; adapted for this study). The CSRI was developed to be easily adaptable to the context of the research in which it is being used (Beecham and Knapp 1999).

Previous experience of stress management training will be monitored with the question: “Have you previously received stress management training including training on relaxation techniques and time management?” To assess levels of sickness absence, participants will be asked if they had taken time off work for a stress related complaint in the previous 8 weeks at time points 1, 2 and 3.

Demographics will include: age, gender, fluency of written and spoken English, country of birth (UK, non-UK), relationship status, work role, number of working hours (low,

middle, high), organisation, education level, income bracket and familiarity with online environment. The full list of measures is depicted in Table App. 3.

Table App. 3: Measures

Measure (number of items)	T1	T2	T3
Primary Measure: Engagement			
<i>Number of logins to the website</i>		(X)	
Secondary Measures: Engagement			
<i>Number of modules completed</i>		(X)	
<i>Number of pages visited</i>		(X)	
<i>Self-report engagement</i>		(X)	
Secondary Measures: Effectiveness			
<i>DASS 21 (21)</i>	X	X	X
<i>IWP Multi Affect Indicator (16)</i>	X	X	X
Other Measures			
<i>Number of visits to discussion group</i>		X*	
<i>Number of contributions to discussion group</i>		X*	
<i>Existing psychological condition</i>	X	X	X
<i>Messages sent to and from coach</i>		(X)	
<i>Demographics</i>	X		
<i>Care as usual (2)</i>	X	X	X
<i>Time perception index (5)</i>	X	X	X
<i>Goal conflicts (3)</i>	X	X	X
<i>Acceptability (6)</i>	X	X	X
<i>Credibility/expectancy (6)</i>		2 weeks	
<i>Level of importance (1)</i>	X		
<i>Negative effects of treatment (1)</i>		X	X
<i>Job autonomy (9)</i>	X		
<i>System usability scale (10)</i>		(X)	
<i>Client satisfaction questionnaire (8)</i>		(X)	
<i>Online support group questionnaire (9)</i>		X*	
<i>Experience of stress management training (1)</i>	X		
<i>Sickness absence for stress related complaint (1)</i>	X	X	X
<i>Contamination question (1)</i>		X	X

Note: T1 = baseline, T2 = 8 weeks (completion of intervention), T3 = 16 weeks (follow-up).

Groups: X = all three groups, (X) =MSG and Discussion Group, X = Discussion Group only.*

1.4.4 Statistical analyses

Analysis of the primary outcome measure (number of logins to the site) will be conducted on an intention-to-treat basis (participants' data is analysed in the group that they randomised to, regardless of treatment they receive or the extent to which they engage with the intervention). Analysis of the secondary measures (psychological distress, and subjective wellbeing) will also be conducted on an intention to treat basis. Missing data will be imputed using the Last Observation Carried Forward method. For the engagement measures where no previous data is available, missing data will be imputed using the group mean. To check the robustness of the primary findings, sensitivity analysis including a per-protocol analysis will be performed. Per-protocol is defined as 3 or more logins to the WorkGuru site. This baseline has been identified from average login data from the site and reflects login data from other studies (for a summary of login data for online health promotion interventions see Brouwer et al., 2011).

Primary and secondary hypotheses will be explored using predominantly descriptive statistics. The means and/or medians (as appropriate) will be reported with standard deviations. Ninety-five percent confidence intervals will be calculated. Standardised effect sizes will be calculated using Cohen's *d*, and where appropriate odds ratios will be reported. Exploratory inferential analysis will be performed using t-tests, ANOVAs and correlations as appropriate. In recognition that this is a pilot study caution will be taken in interpreting and reporting these results.

Baseline differences between groups will be explored using chi-square and ANOVA (as appropriate), and where possible we will compare demographics of trial participants with the workforce of each organisation to see if trial participants are representative of the workforce.

1.5 Discussion

Workplace psychological ill health is a growing problem for both employers and their employees, but while there is clear and convincing evidence for the efficacy of

delivering CBT based online interventions within clinical settings, that evidence has not translated to CBT based online stress management interventions delivered within workplace settings. One explanation for this failure might be the additional challenge of achieving engagement and adherence to an online intervention that is delivered within a dynamic and busy working environment. This is also a challenge to conducting this real world research: to what extent will a workplace setting impact on study recruitment and attrition? There is a danger that potential participants may be reluctant to engage with a stress management program delivered via their workplace for fear of demonstrating vulnerability. We aim to counteract this by maintaining confidentiality between employee and employer. Employing organisations will not be informed of which employees are participating in the research. It may also be possible that the people that the intervention is aimed at (individuals experiencing stress) may feel so time pressured that they are not willing to engage with the study. To counteract this while maintaining confidentiality, we will ask employers to provide a supporting statement suggesting that all employees participating in the research are given one hour a week over the eight week period to complete the program. One of the aims of this pilot study is to gain a greater understanding of the ways to overcome the challenge of enabling employees to access online psychological interventions in the workplace, and to understand more about the challenges of conducting this research within a workplace setting.

Another challenge to this study is making an accurate prediction of effect size. A study by Hilvert-Bruce et al., (2012) compared adherence to an online CBT program before and after changes had been made to the way the intervention was delivered (adding choice of course and timing, and a requirement to pay a fee). Adherence increased after the changes had been made from 37.9% to 60%, an increase of 58%. The average number of lessons completed before the changes per user was 3.72 ($SD = 2$) and 4.63 ($SD = 1.7$) after the changes. This was a significant difference $t(1106) = 8.8, p < .001$. The Cohen's d effect size was $d = 0.53$. However, participants were recruited for the study via prescription from their GP or mental health professional. A stress management intervention such as the one used in the present study which recruits participants with elevated (but not necessarily clinically significant) stress levels is likely to report a smaller effect size than an intervention delivered within a clinical setting (Tan et al., 2014), which makes it difficult to calculate the predicted effect size.

This pilot study, while underpowered so unable to allow us to draw definitive conclusions, will provide the parameters to inform the methods of a definitive trial.

The design of the stress management intervention (WorkGuru) is based on clear theoretical psychological principles, the efficacy for which has been proven in other studies for both face-to-face delivery (for example: van der Klink, Blonk, Schene & van Dijk, 2001; Blonk, Houtman, Brenninkmeijer & Lagerveld, 2006), and for online delivery (for example: Hasson, Anderberg, Theorell & Arnetz, 2005; Rose, 2014). However, the efficacy of the specific online intervention (WorkGuru) has not been established. For this reason, a WLC condition has been included which will help identify the effect of the treatment compared to no treatment. Comparing two active conditions: MSG and Discussion Group, enables the impact of the discussion group on engagement to be isolated.

Other studies have included online discussion groups as part of an online intervention (for example: Titov et al., 2008; Berger et al., 2011; and Alaoui et al., 2015), but failed to either report usage data, differentiate the usage of the groups across the treatment groups, or analyse the impact of the discussion groups on the study outcomes. These studies are failing to include the group as a unique research variable but instead include it as one component of an intervention. This pilot study will address this failure by including the discussion group as the main research variable.

The study by Hilvert-Bruce et al. (2012) found that non-completers still benefited from the intervention but that greater adherence resulted in greater benefit. Adherence to WorkGuru has been established at three logins to the site. This baseline has been established from current WorkGuru usage and in reference to login data from studies on other health promotion sites (see Brouwer et al., 2011). This pilot study will give a greater understanding of the extent to which participants are engaging with the intervention and will enable threshold levels of adherence to be refined.

One of the stated benefits of Internet based or eHealth (the use of information and communication technology for health) interventions is that utilisation or dose can be objectively measured (Norman et al., 2007). The most common objective exposure

measure used in studies is login rates (Brouwer et al., 2011), other measures include number of pages visited, length of visit, and sessions or modules completed. But to what extent do these measures accurately record engagement? Computer based utilisation measures can register whether someone visits a page but not if they have meaningfully engaged with the material. Participants' perception of their engagement may differ from the objective utilisation measure but it isn't clear to what extent that is important. Is our perception of engagement or usage a better indicator of intervention exposure than an objective utilisation measure? This pilot study will help us to get a greater understanding of designing and interpreting utilisation measures, and a greater understanding of how that relates to outcome.

This study has two active groups (MSG and Discussion Group). While it is not possible to blind participants to the type of intervention that they receive which could result in a bias in the self-reported measures, the inclusion of two active groups may limit this bias. A limitation of this study is that while it focuses on engagement the quantitative nature of the study does not allow exploration of why study participants may or may not engage with the intervention. A follow up study using qualitative methodology is being planned to address this by gaining a greater understanding of the experiences of participants that failed to engage with the study, as well as participants that did engage.

One of the strengths of this study is that it is examining engagement and adherence to an online CBT based stress management intervention within a real world context (the workplace). If we want to increase access to evidence-based psychological interventions, and address the growing problem of poor employee psychological health then we need to get a better understanding of how we increase employee engagement to online psychological interventions. This study will help us to do that.

To our knowledge this is the first study that will isolate the effect of an online facilitated discussion group on adherence, engagement and effectiveness of an online CBT based stress management intervention. This study could help close the gap between the efficacy of online CBT based interventions demonstrated within trials conducted in clinical settings and the effectiveness of online CBT based interventions, delivered within real world settings.

Abbreviations

ANOVA: Analysis of Variance

CAU: Care as Usual

CBT: Cognitive Behaviour Therapy

cCBT: Computerised Cognitive Behaviour Therapy

CMHD: Common Mental Health Disorder

CSQ: Client Satisfaction Questionnaire

CSRI: Client Service Receipt Inventory

DASS: Depression Anxiety Stress Scales

GP: General Practitioner

MSG: Minimal Support Group

NICE: National Institute for Health and Care Excellence

ONS: Office for National Statistics

PSS: Perceived Stress Scale

WLC: Wait List Control

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